

QUALITY ASSURANCE PROJECT PLAN

ASHLAND/NSP LAKEFRONT SUPERFUND SITE

ASHLAND, WISCONSIN

August 2003



URS
5250 East Terrace Drive, Suite I
Madison, Wisconsin 53718

URS Project No. 05644-098

NSP/Ashland Lakefront Site – BRRTS# 02-02-000013



August 22, 2003

Mr. Jon Peterson
United States Environmental Protection Agency
Region 5
77 West Jackson Boulevard
Chicago, Illinois 60604-3590

RE: Quality Assurance Project Plan
Ashland/NSP Lakefront Superfund Site
BRRTS# 02-02-000013
URS Project No. 05644-098

Dear Mr. Peterson:

Please find enclosed three copies of the Quality Assurance Project Plan (QAPP) for the Ashland/NSP Lakefront Superfund Site. This QAPP details quality assurance practices for field and laboratory activities for Operable Units (OU) 1 and 2. We have addressed the comments contained in your February 7, 2003 memo regarding the draft QAPP. A supplemental QAPP will be provided for OUs 3 and 4.

Please call us at (608) 244-5656 should you have any questions or comments.

Sincerely,

URS Corporation

A handwritten signature in black ink, appearing to read "Albert W. Cole".

Albert W. Cole
Project Director

cc: Jerry Winslow
Dave Donovan
Dave Trainor
Weldon Bosworth
Dave Crass
Aleeta Roberman
Steve Mlejnek
Jamie Dunn
John Robinson
Mark Gordon

URS Corporation
5250 East Terrace Drive, Suite I
Madison, WI 53718
Tel: 608.244.5656
Fax: 608.244.1779
www.urscorp.com

AUTHORIZATION PAGE

Jon Peterson	Date
USEPA Region 5 Remediation Project Manager	

Aleeta Roberman	Date
USEPA Region 5, Quality Assurance Reviewer	

Bert Cole	Date
URS Corporation Project Coordinator	

Dave Trainor	Date
NewFields Project Manager	

Steve Mlejnek	Date
Northern Lakes Service Laboratory Project Manager	

DISTRIBUTION PAGE

AGENCY PERSONELL:

Mr. Jon Peterson
United States Environmental Protection Agency
Region 5
77 West Jackson Boulevard
Chicago, Illinois 60604-3590

Ms. Aleeta Roberman
United States Environmental Protection Agency
Region 5
77 West Jackson Boulevard
Chicago, Illinois 60604-3590

Mr. Jamie Dunn
Wisconsin Department of Natural Resources
Northern Region Headquarters
810 West Maple Street
Spooner, Wisconsin 54801

PRIMARY CONTACT:

Mr. Jerry Winslow
Xcel Energy
414 Nicollet Mall (Ren. Sq. 8)
Minneapolis, Minnesota 55401

CONSULTANT:

Mr. Bert Cole
URS Corporation
54 Park Place, Suite 950
Appleton, Wisconsin 54914

Mr. Dave Trainor
NewFields
2110 Luann lane, Suite 101
Madison, Wisconsin 53717

LABORATORY SERVICES:

(Soil and Water Samples)
Mr. Steve Mlejnek
Northern Lakes Service, Inc
400 North Lake Avenue
Crandon, Wisconsin 54520

TABLE OF CONTENTS

1.0	PROJECT MANAGEMENT	8
1.1	PROJECT ORGANIZATION AND MANAGMENT	10
1.2	LABORATORY SERVICES	12
1.3	ORGANIZATION CHART.....	14
2.0	PROBLEM DEFINITION AND BACKGROUND INFORMATION.....	16
2.1	PROBLEM DEFINITION.....	16
2.2	SITE DESCRIPTION	18
2.3	BACKGROUND	19
2.4	POTENTIAL CONTAMINANTS.....	21
3.0	PROJECT TASK DESCRIPTION.....	23
3.1	DATA QUALITY OBJECTIVES	23
3.2	TARGET PARAMETERS	24
3.3	SAMPLING RATIONALE	24
3.4	ANALYTICAL PROCEDURES.....	27
3.5	DATA VALIDATION.....	28
3.6	QUALITY ASSURANCE ASSESSMENT	28
3.7	DATA USABILITY ASSESSMENT.....	29
3.8	PROJECT DOCUMENTS, RECORDS AND REPORTS	29
3.9	PROJECT SCHEDULE.....	29
4.0	QUALITY OBJECTIVES AND CRITERIA FOR MEASUREMENT DATA.....	31
4.1	DATA QUALITY OBJECTIVES PROCESS.....	31
4.2	MEASUREMENT PERFORMANCE CRITERIA - PARCC.....	31
4.2.1	PRECISION.....	32
4.2.2	ACCURACY	32
4.2.3	REPRESENTATIVENESS	33
4.2.4	COMPLETNESS	33
4.2.5	COMPARABILITY.....	34
4.3	SPECIAL TRAINING REQUIREMENTS / CERTIFICATIONS	34
4.4	DOCUMENTATION AND RECORDS	34
4.4.1	SAMPLE COLLECTION RECORDS	34
4.4.2	QC SAMPLE RECORDS.....	35
4.4.3	FIELD ANALYSIS RECORDS	35
4.4.4	FIXED LABORATORY RECORDS	35
4.4.5	DATA HANDLING RECORDS.....	35
4.5	DATA REPORTING PACKAGE FORMAT AND DOCUMENTATION CONTROL.....	35

TABLE OF CONTENTS

4.6	DATA REPORTING PACKAGE ARCHIVING AND RETRIEVAL	36
5.0	QUALITY ASSURANCE PROJECT PLAN ELEMENT	37
5.1	GROUNDWATER SAMPLE COLLECTION PROCEDURES	38
5.2	DOCUMENTATION OF FIELD ACTIVITIES	38
5.3	SAMPLE HANDLING.....	40
5.4	CALIBRATION PROCEDURES EQUIPMENT, CONTAINERS, AND SUPPLIES.....	41
5.4.1	LABORATORY INSTRUMENT CALIBRATION PROCEDURES.....	41
5.4.2	FIELD INSTRUMENTS/EQUIPMENT CALIBRATION PROCEDURES.....	41
5.4.3	EQUIPMENT, SUPPLIES, AND CONTAINERS	42
5.5	INSTRUMENT/EQUIPMENT INSPECTIONS AND MAINTENANCE	44
5.5.1	FIELD INSTRUMENT MAINTENANCE	44
5.5.2	FIELD INSTRUMENT MAINTENANCE	44
5.6	CHAIN OF CUSTODY PROCEDURES.....	45
5.6.1	SAMPLE CUSTODY OVERVIEW.....	45
5.6.2	SAMPLE CUSTODY IN THE FIELD.....	46
5.6.3	LABORATORY CHAIN OF CUSTODY PROCEDURES	47
5.6.4	PROJECT FILE CUSTODY PROCEDURES	47
5.7	COLLECTION OF QUALITY CONTROL SAMPLES.....	48
5.8	LABORATORY ANALYSIS	49
6.0	QUALITY ASSURANCE PROJECT PLAN ELEMENT	51
6.1	DATA ASSESSMENT AND OVERSIGHT.....	51
6.1.1	FIELD SAMPLING TECHNICAL SYSTEM AUDIT (TSA)	51
6.1.2	DATA PACKAGE TSA	51
6.1.3	FINDINGS AND CORRECTIVE ACTION RESPONSES.....	51
7.0	DATA VERIFICATION AND VALIDATION	52
7.1	DATA REDUCTION, REPORTING, AND VALIDATION	52
7.1.1	DATA REDUCTION	52
7.1.2	DATA REPORTING.....	52
7.1.3	DATA USABILITY	53
7.1.4	DATA VALIDATION.....	53
7.2	DATA MANAGEMENT PLAN	54

List of Tables, Figures and Appendices

Tables

Table 1	Summary of Constituents of Concern – Soil
Table 2	Summary of Constituents of Concern – Groundwater
Table 3	Summary of Sampling and Analysis Program
Table 4	DQO Steps for the OU 1 and OU 2 Remedial Investigation
Table 5	QA Objectives for Field Measurements
Table 6	QA Objectives for Laboratory Measurements
Table 7	Sample Container, Preservation, and Holding Time Requirements
Table 8	Field Preventative Maintenance Procedures and Frequencies of Checks
Table 9	Examples of Maintenance Procedures and Frequencies for Major Analytical Instrumentation

Figures

Figure 1	Site Location Map
Figure 2	Site Map
Figure 3	Locations of Existing Monitoring Wells, Piezometers, Artesian Wells and Relevant Borings
Figure 4	Locations of Proposed Piezometers, Geoprobe Borings and Surface Soil Samples
Figure 5	Project Schedule

Appendices

Appendix A	URS Standard Operating Procedures
Appendix B	Northern Lakes Service, Inc. Quality Assurance/Quality Control Manual and Project Specific Attachments

SECTION ONE

PROJECT MANAGEMENT

This Quality Assurance Project Plan (QAPP) describes procedures to be followed and details related to quality assurance (QA) and quality control (QC) for additional characterization of the Ashland/NSP Lakefront Superfund Site (the "Site"). The Site contains property owned by Northern States Power Company, a Wisconsin corporation (d.b.a. Xcel Energy, a subsidiary of Xcel Energy Inc. ("NSP")), a portion of Kreher Park¹, a City owned property fronting on the bay, the former City Waste Water Treatment Plant (WWTP), also located at Kreher Park, and an inlet area containing contaminated sediment directly offshore from the former WWTP. The Site includes four operable units (OUs). These include: OU 1, a filled ravine on the NSP property that formerly opened to the lakeshore prior to the filling of the present Kreher Park; OU 2, a deep confined aquifer, the Copper Falls, separated from the near surface fill soils by the Miller Creek Formation, a silty clay aquitard; OU-3, Kreher Park and the former WWTP; and OU-4 the affected offshore sediments. The primary contaminants at each operable unit are coal tar/creosote like compounds, volatile organic compounds (VOCs), and poly aromatic hydrocarbons (PAHs).

Additional characterization for which this QAPP has been prepared will be limited to OU-1 and OU-2. The QA/QC requirements for this project are described in this section. This QAPP, once approved, will govern all further data collection efforts undertaken by URS on behalf of NSP including any on-going groundwater monitoring and other activities.

This QAPP has been revised to incorporate USEPA comments presented in a February 7, 2003 memo following the review of the December 2003 draft QAPP (Revision 00). Revisions to this QAPP will be made as needed following USEPA review and for additional characterization of shallow soil and groundwater in Kreher Park (OU-3) and additional evaluation of contaminated nearshore sediments in the inlet adjacent to Kreher Park (OU-4).

QA/QC addresses the procedures involved in the collection, preservation, packaging, and transport of samples; field testing; record keeping; data management; chain-of-custody procedures; laboratory analyses; and other necessary matters to ensure that sample collection, once completed, will yield data with integrity that can be defended. Generally, QC is concerned

¹ Reference to this portion of the Site as Kreher Park developed colloquially over the course of this project. Kreher Park consists of a swimming beach, a boat landing, an RV park and adjoining open space east of Prentice Avenue, lying to the east of the subject study area of the Site. For purposes of this work plan and to be consistent with past reports referenced in this plan, the portion of the Site to the west of Prentice Avenue, east of Ellis Avenue and north of the NSP property is referred to as the "Kreher Park Area" or simply Kreher Park.

SECTION ONE

PROJECT MANAGEMENT

with the day-to-day efforts to verify that site-specific activities are in conformance with approved plans, procedures, and specifications. Conversely, QA is the implementation and monitoring of the performance of QC activities, such as performance and system audits.

Adherence to Standard Operating Procedures (SOPs) provided in Appendix A by project personnel, supervision of key tasks by experienced personnel, and inspections or audits of selected field and laboratory activities will collectively serve to ensure the integrity of project results and meet the QA/QC requirements appropriate for this project.

Predominant field activities that will take place at the Site include the collection and analysis of groundwater samples from existing wells, and the collection of subsurface soil and surface soil samples. A discussion of the field procedures and QA/QC protocols are presented in this report; reference is frequently made to SOPs, which are presented in Appendix A.

The field QC procedures which will be followed to ensure that field activities are properly documented and performed are described in this report. QC procedures described in this report include:

- Sample collection procedures;
- Documentation of field activities;
- Calibration procedures and equipment;
- Sample container preparation;
- Chain-of-custody procedures;
- Collection of quality control samples; and
- Laboratory analysis.

All site activities will be completed in accordance with Agency approved work plans. These work plans will include a description of the sample collection methods, number and location of samples, and laboratory analysis that will be performed. Additional areas of investigation have been identified during technical meetings among WDNR, USEPA and NSP on November 4 and November 19, 2002, and January 6, 2003, and are reflected in the scope of work proposed in the draft Remedial Investigation/Feasibility Study (RI/FS) Work Plan submitted concurrent with this document.

SECTION ONE

PROJECT MANAGEMENT

1.1 PROJECT ORGANIZATION AND MANAGMENT

The project organization and responsibilities of key individuals of the URS project team are described below. URS has subcontracted with NewFields for project management activities. The project will be coordinated out of the URS Appleton office with Project Management from the Madison NewFields office. Field personnel from the URS Madison office will perform the various field activities for the project.

Project leadership and primary staff will be composed of personnel familiar with anticipated activities. The URS project team will provide experience in hydrogeologic analysis, environmental engineering, risk assessment, and remedial design. Brief descriptions of key project team members follow.

Project Coordinator

Mr. Bert Cole will serve as the URS project coordinator. Mr. Cole is a Senior Environmental Engineer with more than 29 years of experience in the environmental field. The Project Coordinator is responsible for the overall quality of the project, along with the oversight of subcontractors and tracking budgets. The Project Coordinator will also work with the Project Manager in developing schedules and workplans, establishment of project policies and procedures, and review and analyze overall task performance.

Project Manager

David Trainor, P.E.,P.G., of NewFields will function as Project Manager for the project, as a subcontractor to URS. Mr. Trainor has more than 22 years of experience in the environmental field. Mr. Trainor has served as the Project Manager for the NSP/Ashland Lakefront project since the initial investigation was completed in 1995. The Project Manager is responsible for managing the project, and has the authority to commit the resources necessary to meet project objectives and requirements. The Project Manager's primary function is to ensure that technical, financial, and scheduling objectives are achieved. The Project Manager will provide the major

SECTION ONE

PROJECT MANAGEMENT

point of contact and control for matters concerning the project, and will be responsible for the following:

- Define project objectives to develop detailed schedules for work plans;
- Develop and implement work plans, schedules, and adherence to management-developed study requirements;
- Establish project policies and procedures to address the specific needs of the project as a whole, as well as the objectives of each task;
- Acquire and apply technical and corporate resources as needed to ensure performance within budget and schedule constraints;
- Coordinate and manage field staff that are collecting soil and groundwater samples and supervising drilling activities;
- Orient all field leaders and support staff concerning the project's special considerations;
- Provide day-to-day coordination on technical issues in specific areas of expertise with the field managers;
- Develop and meet ongoing project and/or task staffing requirements, including mechanisms to review and evaluate each task product;
- Review the work performed on each task to ensure its quality, responsiveness, and timeliness; and,
- Review and analyze overall task performance with respect to planned requirements and authorizations; and
- Represent the project team at meetings and public hearings.

~~The URS Project Manager has overall responsibility for ensuring that the project meets Agency and PRP objectives and URS's quality standards, and will be responsible for overall technical supervision and quality assurance/quality control. Ms. Kelly Mattfield will serve as the Quality Assurance Manager for this project and will be responsible for the following:~~

- Review and approval of the QAPP;
- Coordinating data validation, data assessment, and internal and external system audits;
- Overall technical supervision and QA/QC;
- Approving all external reports (deliverables) before their submission to the Agency; and
- Ultimately responsible for the preparation and quality of interim and final reports.

SECTION ONE

PROJECT MANAGEMENT

Field Manager(s)

Field Manager(s) will be responsible for performing field measurements, supervising drilling and well installation activities, preparing field boring logs, collecting soil samples, collecting groundwater samples, preparing samples for shipment, and documenting field conditions and observations. Field managers will be experienced professionals who possess the technical competence to effectively perform the required work. Field Managers will also identify any problems at the Site and discuss resolutions of potential problems with the Project Manager. Field Managers will report directly to the Project Manager. Field Manager responsibilities include:

- Implementation of QA/QC procedures required by the Field Manager;
- Adherence to work schedules provided by the project director;
- Review of text and graphics required for site activities;
- Coordination and oversight of technical efforts of sub-contractors assisting the field team;
- Identification of problems in the field, and discussion of resolutions with the project director,
- Assistance with data analysis and report preparation.

QAPP Preparer

~~Ms. Kelly Mattfield, PE, a Senior Engineer with URS's Madison office is responsible for preparation of this QAPP for the OU 1 and OU 2 sampling activities.~~

1.2 LABORATORY SERVICES

Analytical laboratory services for this project will be provided by Northern Lake Service, Inc. (NLS) of Crandon, Wisconsin. NLS will provide analytical services for all soil and groundwater samples.

The NLS Project Manager for this project will be Mr. Steve Mlejnek. NLS's organization and responsibilities are described in detail in NLS's Quality Assurance/Quality Control (QA/QC) Manual included in Appendix B. (Project specific information is included in Appendix B as

SECTION ONE

PROJECT MANAGEMENT

attachments to NLS's QA/QC Manual.) A brief summary of laboratory organization and responsibilities follows:

Laboratory Project Manager

- Coordinates the completion and delivery of the final analytical report;
- Ensures that client objectives are met; and
- Oversees the overall completeness of the final analytical report.

Laboratory Inorganic and Organic Operations Supervisors

- Directs the laboratory's analytical programs
- Coordinates projects and associated workloads;
- Executes laboratory administrative functions; and
- Ensures compliance with appropriate analytical methods.

Laboratory Quality Assurance Officer/Manager

- Overview laboratory quality assurance;
- Overview QA/QC documentation;
- Overseeing of detailed data review;
- ~~Decides laboratory corrective actions, if required;~~
- Technical representation of laboratory QA procedures;
- Preparation of laboratory Standard Operation Procedures; and
- Approval of Quality Assurance Manuals.

Laboratory Analysts

- Responsible for equipment maintenance and calibration;
- Assume direct responsibility for data generation;
- Self-review of generated data;
- Documentation of sample analysis anomalies; and
- Inclusion of appropriate quality control samples into analysis scheme.

SECTION ONE

PROJECT MANAGEMENT

Laboratory Sample Custodians

- Receive and inspect the incoming sample containers;
- Record the condition of the incoming sample containers;
- Sign appropriate documents;
- Verify chain of custody and its correctness;
- Notify laboratory project manager and laboratory analysts of sample receipt and inspection;
- Assign a unique identification number and customer number, and enter each into the data management system; and
- Arrange proper secure sample storage.

The primary responsibility for project quality rests with the URS Project Manager. Independent quality assurance will be provided by each laboratory Project Manager, the Inorganic Operations Supervisor, the Organic Operations Supervisor, the Quality Assurance Officer/Manager, Laboratory Analysts, and Laboratory Sample Custodians as required prior to release of all data to URS.

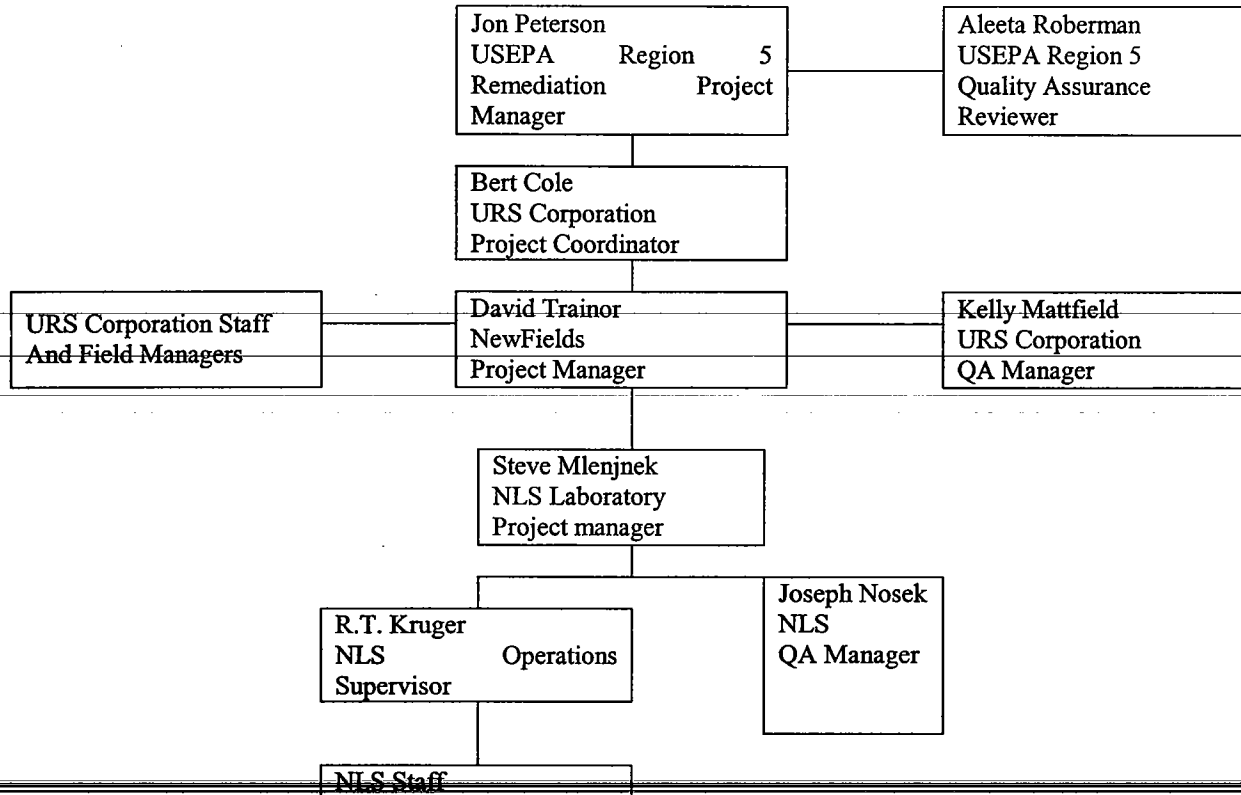
1.3 ORGANIZATION CHART

The organization chart showing the relationships and the lines of communication among the project participants to shown below.

SECTION ONE

PROJECT MANAGEMENT

ASHLAND NSP LAKEFRONT SUPERFUND SITE ORGANIZATIONAL CHART



SECTION TWO

Problem Definition and Background Information

2.1 PROBLEM DEFINITION

The Site consists of approximately 20 acres of affected land located on the shore of Chequamegon Bay of Lake Superior, in Ashland, Wisconsin. The NSP property, located on an upland area above a bluff face fronting on Kreher Park, is the site of a former manufactured gas plant (MGP) that operated between 1885 and 1947. Kreher Park includes reclaimed lands from the bay filled during the 1800s when the area was the site of major lumbering operations. The most significant of these operations was the John Schroeder Lumber Company, which operated a sawmill, a planing mill, a wood treatment facility and a shipping facility on the lakefront between 1901 and 1939. Uncontrolled filling of this area continued in the 1940s and 1950s when the property was owned by the City of Ashland and used as a waste disposal site.

A description of the Site is presented in the Section 2.2. Contamination can be divided into the following four operable units (OU) as follows:

- **Operable Unit 1 (OU-1)** – Consists of soil and groundwater contamination, and free phase coal tar within the backfilled ravine on the NSP property.
- **Operable Unit 2 (OU-2)** – Consists of groundwater contamination and free phase coal tar in the Copper Falls aquifer originating on the NSP property.
- **Operable Unit 3 (OU-3)** – Consists of soil and groundwater contamination in the fill material in Kreher Park.
- **Operable Unit 4 (OU-4)** – Consists of sediment contamination in the near shore area adjacent to Kreher Park.

The primary contaminants at each operable unit are coal tar/creosote like compounds, volatile organic compounds (VOCs), and poly aromatic hydrocarbons (PAHs). The most abundant compound from each of these compound groups includes benzene and naphthalene. Soils and groundwater contaminated with these compounds are present at OUs 1 and 3. In addition, free-product coal tar present as a dense non-aqueous phase liquid (DNAPL) is found in the upper reaches of the ravine on the NSP property, and at Kreher Park where an underground clay tile that extended the length of the ravine intermittently discharged at the surface at the “seep” area of the Park. Free-product coal tar is also found in the upper deposits of the Copper Falls Aquifer (OU 2). This free-product has resulted in a dissolved phase plume that extends north from the

SECTION TWO

Problem Definition and Background Information

area of the free-product in the direction of groundwater flow, beyond the shoreline of the Bay. However, the Miller Creek Aquifer prevents cross-contamination from OU 2 to OU 3 and OU 4. Free-product is also present in the sediments. The area of affected sediments covers approximately nine acres. It is within these sediments where the highest contaminant levels of VOCs and PAHs have been found.

As described in Section 2.3, several phases of investigation have been completed, and two interim remedial responses have been implemented by NSP. A series of technical meetings were held during the fall and winter of 2002/2003 among NSP, WDNR and USEPA to discuss these RI activities for further site characterization. Because of seasonal weather access constraints and the need to meet the winter deadline for "ice-out," the first of these RI activities included supplementary sediment sampling on the bay sediments for further physical characterization of these sediments. In accordance with USEPA approval, WDNR implemented an investigation of the sediments during March 2003, to allow easy access from winter ice. Further RI work however, was not implemented.

During this same timeframe (i.e., fall/winter 2002-2003), NSP began discussions with USEPA and WDNR regarding work that NSP was prepared to implement. Following discussions with USEPA in early 2003, NSP was informally notified that USEPA would seek that NSP enter into an Administrative Order on Consent (AOC) for performance of the RI/FS at the Site. The formal General Notice letter and proposed AOC with an attached Statement of Work (SOW) was received by NSP on August 8, 2003.

The draft SOW requires submittal of a draft Remedial Investigation/Feasibility Study ("RI/FS") Work Plan. A draft RI/FS Work Plan has been developed and submitted to USEPA concurrent with this QAPP. These documents have been prepared and submitted prior to finalizing the AOC/SOW between USEPA and NSP so that USEPA review can be initiated in 2003 to minimize delay. Implementation of the scope of work presented in the draft RI/FS Work Plan is both contingent upon USEPA approval pursuant to the final AOC to be negotiated between the parties. Additional submittals called for in the AOC/SOW under discussion include the following:

SECTION TWO

Problem Definition and Background Information

- Final Remedial Investigation/Feasibility Study Work Plan;
- Site Management Plan;
- Pollution Control and Mitigation Plan;
- Waste Management Plan;
- Health and Safety Plan;
- Field Sampling Plan; and
- Data Management Plan

A QAPP will also be required for compliance with the AOC/SOW. The intended use for this QAPP is for. Limited to the further characterization of OU-1 and OU-2, which will include the collection of soil samples, the installation of piezometers, and the collection of groundwater samples. The QAPP will be updated as needed as other tasks of the RI are implemented.

2.2 SITE DESCRIPTION

NSP operates an administration and service facility (storage for energy transmission, operation, and maintenance equipment) located at 301 Lake Shore Drive East in Ashland, Wisconsin. This property is at the location of a former Manufactured Gas Plant (MGP) that was operated by a predecessor company on the property between 1885 and 1947. The former gas plant building has been incorporated into the current service facility, which is a block long "U" shaped building south of St. Claire Street. The former MGP building comprises the eastern one-third of this building. An administration office fronting on Lake Shore Drive and parking lot are located south of the service building on the same city block, separated by an alley.

The Site is located within the City Limits of Ashland, and generally surrounded by city streets. Lake Shore Drive (also U.S. Highway 2) bounds the Site to the south. Prentice Avenue and 3rd Avenue East bound the Site to the east and west, respectively. St. Claire Street bounds the Site to the north. NSP also owns undeveloped property to the north side of St. Claire Street between 3rd Avenue East and Prentice Avenue, south of Kreher Park, and a parcel of property on the northeast corner at the intersection of Prentice Avenue and St. Claire Street. Both parcels of property are fenced and used to store spare equipment and supplies.

SECTION TWO

Problem Definition and Background Information

Surrounding properties include: a grocery store and parking lot on the south side of Lake Shore Drive; Our Lady of The Lake's church, school, and parking lot west of 3rd Avenue; residential homes on the north side of St. Claire Street between the two NSP storage yard properties, and residential homes east of Prentice Avenue and the NSP property. Kreher Park and Chequamegon Bay are located north of the NSP storage yard properties and railway corridor. The Site location is shown on Figure 1, and Site features are shown on Figure 2.

2.3 BACKGROUND

Several phases of site investigation have been completed at the facility since 1995. These investigations identified soil and groundwater contamination on the NSP property. Results of the investigations show that a filled ravine is located on the property; the ravine is filled with cinders, ash, demolition material (bricks, concrete, etc.), and fill soil. This filled ravine begins at Lake Shore Drive and opens to Kreher Park. Because the fill material is more permeable than the surrounding Miller Creek till (the surficial unconsolidated geologic unit at the Site), the saturated portion of the ravine fill behaves as a perched aquifer. The Miller Creek till is composed of a fine grained low permeability silty clay. Coal tar has been encountered in wells MW-9, TW-13, and MW-15 screened within the backfilled ravine. Coal tar constituents in the soil within the backfilled ravine exceeds Wisconsin Administrative Code NR chapter 720 soil cleanup standards, and contaminants in the groundwater within the ravine exceeds Wisconsin Administrative Code chapter NR 140 groundwater quality standards.

Site investigation results also show that coal tar migrated vertically into the underlying Copper Falls aquifer. The Copper Falls aquifer in the area of the former MGP is a confined aquifer with strong upward vertical gradients. The Miller Creek formation behaves as an aquitard, or confining unit for the Copper Falls aquifer. These upward vertical gradients have limited the vertical migration of coal tar, minimizing downward movement of the coal tar through the depth of the Copper Falls aquifer. However, the long-term presence of the tar in the aquifer (since the early operation of the MGP) has resulted in a plume of dissolved contaminants in the groundwater extending north beneath Kreher Park. Groundwater within the identified plume is not currently being used as a potable water supply, or is a threat to the City of Ashland's drinking water source (Lake Superior).

SECTION TWO

Problem Definition and Background Information

Because the coal tar source area is limited to a small area west of the former plant building, in the courtyard area of the service facility immediately south of St. Claire Street, URS, on behalf of NSP, designed, coordinated the construction, and is overseeing the operation of a coal tar recovery system for the Copper Falls Aquifer as an interim response. This remediation system was constructed on NSP property, and is currently extracting coal tar from the underlying aquifer. The system is also capable of treating groundwater that is removed concurrent with the removal of the tar. Coal tar is separated and collected in a holding tank, and then transported off-site for proper disposal. Water is treated in accordance with standards set by the City of Ashland, and discharged to the City's sanitary sewer system. (Treating groundwater is a secondary function of the system, compared to its primary function of coal tar extraction and separation.)

The interim response coal tar recovery system was installed in the fall of 2000, and became fully operational in January 2001. More than 5,000 gallons of coal tar has been removed, and nearly 750,000 gallons of contaminated groundwater has been treated between January 2001 and July 2003. Influent and effluent air monitoring results indicate the air diffuser and vapor phase carbon adsorption systems are effectively removing volatile organic contaminants discharged by the air diffuser. Influent and effluent water samples indicate that the air diffuser and liquid phase carbon units are effectively treating contaminated groundwater prior to discharge to the sanitary sewer.

During the spring of 2002, NSP implemented a second interim action on groundwater migrating through the buried ravine. This interim action was implemented to capture groundwater migrating through and around a clay tile that had likely been installed at the base of the ravine in the late 1800's prior to its filling. Through several subsurface investigations at both Kreher Park as well as on the NSP property, this tile was determined to be a source of an intermittent groundwater discharge near the mouth of the ravine on the park property, referred to as the "seep." Samples from the seep had yielded high levels of coal tar constituents. As a result, NSP installed an extraction well screened to intercept the base of the former ravine at its mouth at the north boundary of its property. The discharge from this well is routed to the existing water treatment system, where it is treated along with contaminated groundwater from the Copper Falls aquifer prior to discharge to a sanitary sewer. Additionally this second interim action included the removal of contaminated surface soils in the seep area, and the installation of a compacted

SECTION TWO

Problem Definition and Background Information

clay barrier at Kreher Park as a further measure to protect from potential direct human and terrestrial wildlife contact.

Groundwater samples have been collected from piezometers screened in the Copper Falls Aquifer quarterly since September 2000. Results are summarized in quarterly reports submitted to the Wisconsin Department of Natural Resources (WDNR). Groundwater monitoring results indicate that the presence of coal tar in the Copper Falls Aquifer has resulted in an impact to groundwater quality in the vicinity of the former MGP. The primary constituents of regulatory concern include benzene, ethylbenzene, naphthalene, toluene, total trimethylbenzenes, and total xylenes. Several poly-aromatic hydrocarbon compounds (benzo(b)fluoranthene, benzo(a)pyrene, chrysene) have also been detected in samples above groundwater quality standards. Since the coal tar recovery system has been in operation, eight additional piezometers were installed in the Copper Falls formation (six in February 2002 and two in June 2002), to further characterize the contaminant distribution pattern in the Copper Falls formation. The locations of existing monitoring wells, piezometers and relevant soil borings are shown on Figure 3.

2.4 POTENTIAL CONTAMINANTS

MGP operations historically conducted at the site resulted in the creation of coal tar as a co-product. Coal tar is a dark, oily material that had various commercial uses. Some tar was sold or reused as boiler fuel, but some tar was also released to the environment during the operational life of the MGP.

The Schroeder Lumber Company occupied the Kreher Park property between 1901 and 1939 as a sawmill/wood processing facility. Evidence indicates Schroeder conducted wood treatment at the site using coal tar/creosote material. Following Schroeder's active tenure, Ashland County acquired the property in 1939. In 1942, Ashland County transferred title of the former Schroeder Lumber Company property to the City of Ashland, and the City has owned the land since that time. In the 1940's the City operated the northwest portion of Kreher Park as a waste disposal facility (landfill). In 1951, the City constructed a wastewater treatment plant (POTW) on the property, maintaining the plant until 1989. At that time, the City abandoned the plant because coal tar or wood treatment residual contamination was found in an area of the Park that had been

SECTION TWO

Problem Definition and Background Information

proposed for plant expansion. The extension of the Ellis Avenue marina was completed in the mid-1980's.

Previous analytical results have indicated the presence of VOCs, SVOCs, and metals. Many of these compounds are typically associated with one or more of the above mentioned potential sources of contamination.

Compounds typically associated with manufactured gas plants byproducts and waste include metals, VOCs, and SVOCs, along with ammonia, cyanide, nitrate, sulfate, and sulfide. Wood treatment and preservation methods often included the use of coal tar/kerosene mixtures or creosote (actively distilled from coal tar). Creosote is comprised primarily of various polynuclear aromatic hydrocarbons (PAHs). The waste materials deposited on site have reportedly included slabwood, sawdust, fly ash and municipal solid and industrial waste. These various materials have helped to define the potential contaminants at the site.

SECTION THREE

Project Task Description

3.1 DATA QUALITY OBJECTIVES

DQOs have been prepared to ensure that data proposed for collection would be of sufficient quality, appropriate for the intended uses, and useful in meeting RI/FS objectives. DQOs for the OU 1 and OU 2 tasks at the Site include the following:

- Utilize laboratory procedures and the appropriate analytical support (i.e. data validation) for identifying contamination consistent with the levels for remedial action objectives identified in the National Contingency Plan.
- Identify the vertical and lateral extent of soil and groundwater contamination in the Ravine Fill (OU-1), the vertical and lateral extent of groundwater contamination in the Copper Falls Aquifer (OU-2), utilizing historical and RI generated data;
- Further characterize the lateral and vertical extent of DNAPL in each operable unit;
- Utilize historical and RI generated Site data to interpret geologic and hydrogeologic conditions with respect to evaluating contaminant migration pathways and the fate and transport of contaminants;
- Generate laboratory data with appropriate detection limits to compare to media specific cleanup standards and to assess attainment of risk-based criteria.
- Analyze historic and RI generated groundwater data with respect to Wisconsin groundwater quality standards (Preventive Action Limits (PAL) and Enforcement Standards (ES) per Wisconsin Administrative Code NR 140.);
- Analyze historic and RI generated soil data with respect to Wisconsin soil clean-up standards (residual soil contaminant levels (RCLs) and soil screening levels (SSLs) per Wisconsin Administrative Codes NR 720 and 746, respectively).

SECTION THREE

Project Task Description

- To utilize historic and RI generated data necessary to perform human health and ecological risk assessments;
- To utilize historic and RI generated data necessary to develop site specific cleanup standards protective of human health and the environment; and,
- To utilize historic and RI generated data for the evaluation of potential remedial alternatives that will achieve site specific cleanup standards protective of human health and the environment.

3.2 TARGET PARAMETERS

Soil samples collected from OU 1 will be analyzed for metals, volatile organic compounds (VOCs), and semi-volatile organic compounds (SVOCs) listed in Table 1 (attached). This table includes the project required action limits and quantitation limits, along with the analytical method detection limits.

All groundwater samples will be analyzed for total cyanide, metals, volatile organic compounds (VOCs) and semi-volatile organic compounds (SVOCs) listed in Table 2 (attached). This table includes the project required action limits and quantitation limits, along with the analytical method detection limits.

3.3 SAMPLING RATIONALE

As described in the draft RI/FS Work Plan, soil samples in OU 1 will be used to further characterize contamination in OU-1 and OU-2. A field investigation will be completed in the vicinity of the former MGP and to document background conditions. Additional soil samples will be collected from Geoprobe borings advanced in the ravine fill unit. Surficial soil samples will be collected from unpaved areas around the former MGP facility to evaluate potential contamination in surficial soils for the direct contact risk to human health. Additional piezometers will be installed in the Copper Falls aquifer, and groundwater samples will be collected from the new wells. A detailed description of each task follows:

SECTION THREE

Project Task Description

Geoprobe Soil Borings

Geoprobe borings will be advanced a minimum of five feet below the base of the filled ravine, or to a maximum depth of 20 feet. Soil samples will be collected continuously, and visually classified by a geologist. Samples will be collected every two feet, and field screened with a photo-ionization detector (PID) equipped with a 10.6 eV lamp. Field screening results will be used to select soil samples for laboratory analysis. Samples submitted for laboratory analysis will be selected at the rate of one sample for every 10 feet of drilling. Proposed Geoprobe locations are shown on Figure 4.

Additional subsurface soil samples will also be collected from Geoprobe borings to evaluate background conditions. Background subsurface soil samples will be collected at intervals of 5, 10, and 15 feet from three borings advanced on the NSP property east, south, and west of the former MGP. These three borings will be advanced within 15 feet of the North side of Lakeshore Drive between Prentice and 3rd Avenues at locations 50, 100, and 150 feet west of Prentice Avenue. These locations were chosen to represent up gradient soil background outside the limits of the filled ravine. Seven of these samples will be selected for laboratory analysis.

Surficial Soil Samples

Soil samples will be collected from unpaved areas around the former MGP facility to evaluate potential contamination within surficial soils for the direct contact risk to human health. Soil sample locations SS-1 through SS-12 are shown on Figure 4. Samples collected from the SS-1, SS-10, SS-11, and SS-12 will be used to represent background conditions.

At each sample location, soil will be collected from a depth between 3 and 12-inches utilizing hand tools. Samples will be placed in laboratory containers, held on ice, and shipped to the laboratory along with a completed chain-of-custody form.

Piezometer Installation and Groundwater Sample Collection

Additional piezometers will be installed on at the Site at the locations shown on Figure 4. These wells will be installed as follows:

SECTION THREE

Project Task Description

- MW-2C will be installed adjacent to existing wells MW-2R/MW-2AR in the underlying bedrock unit at an estimated depth of 200 feet;
- MW-7B will be installed adjacent to MW-7A in the former seep area at a depth of 55 feet below ground surface (20 feet deeper than MW-7A);
- MW-15A and MW-15B will be installed adjacent to existing well MW-15 located south of the NSP service center building. Piezometer MW-15A will be installed at a depth of 35 feet below ground surface, and piezometer MW-15B will be installed at a depth of 55 feet below ground surface;
- MW-21B will be installed adjacent to existing well MW-21A on the adjacent property east of the NSP facility at a depth of 55 feet below ground surface (20 feet deeper than MW-21A); and
- MW-23A and MW-23B will be installed in Kreher Park north of MW-21A and west of MW-7A. Piezometer MW-23A will be installed at a depth of 35 feet below ground surface, and piezometer MW-23B will be installed at a depth of 55 feet below ground surface.

Because MW-2C will be installed in an area where coal tar has been encountered, an outer well casing consisting of 6-inch diameter black iron casing will be installed to a depth of 60 feet. A 6-inch diameter boring will be advanced through the outer casing. Soil samples will be collected at 5-foot intervals below 60 feet, and visually classified by a URS geologist. A piezometer consisting of 2-inch diameter schedule 80 PVC well casing and screen will be installed in the uppermost bedrock. A well screen 5-feet in length with 0.010-inch slot size openings will be installed a minimum of 10 feet below the bedrock surface. The sand pack will be placed around the well screen, and the annular space seal will be backfilled with bentonite slurry tremied in place. The well will then be encased in flush mount protective well casing cemented in place.

The remaining piezometers will be installed in borings advanced with 4-1/4-inch ID hollow stem augers. Soil samples will be collected at 5-foot intervals from the ground surface with a split-barrel sampler, and visually classified by a URS geologist. Soil samples will be field screened with a photoinization device (PID) equipped with a 10.6 eV lamp. Field screening results will be used to select screen depth intervals. If coal tar is observed in recovered soil samples, the shallow piezometer well screen will be placed at that interval. If coal tar is not encountered in

SECTION THREE

Project Task Description

recovered soil samples, then the shallow piezometer will be installed at the Miller Creek/Copper Falls interface. The deep piezometer will be installed in the Copper Falls formation 20 feet below the shallow piezometer. Both piezometers will be constructed with a 2-inch diameter schedule 40 PVC well casing and screen, and encased in flush mount protective well casing. Well screens five feet in length with 0.010-inch slot size openings will be used. The sand pack will be placed around the well screens as the augers are removed, and the annular space seal will be backfilled with bentonite slurry tremied in place. Access for well installation at the Kreher Park locations will be contingent on obtaining access from the City of Ashland.

Prior to groundwater sample collection, static water levels will be measured in all Site wells with a water level indicator. The procedures for using the water level indicator are described in Standard Operating Procedure (SOP) 100 included in Appendix A.

Each well will be purged with a dedicated bailer, or submersible pump. Purge volumes and the color, odor, and turbidity of each will be noted on field sampling forms. The condition of the well will also be recorded at the time of sample collection. The procedures for determining pH, specific conductance, and temperature are detailed in SOPs 110, 120, and 130 in Appendix A.

Groundwater samples from OU 2 will be utilized for site characterization, potential ecological and human health risk assessment, and for remedial action alternative evaluation, as necessary. ~~Samples will not be collected from any piezometers if more than 12 inches of coal tar is measured.~~

One duplicate sample will be collected for every 10 groundwater samples. Table 3 includes a list of field and QC samples that will be collected for both soil and groundwater samples. A complete description of sampling methods and associated sample quality control, along with sample, sample handling and custody procedures are outlined in Section 5.

3.4 ANALYTICAL PROCEDURES

Analytical laboratory services for all soil and groundwater samples will be provided by Northern Lake Service, Inc. (NLS) of Crandon, Wisconsin. VOCs will be analyzed by Method 8260, SVOCs by Method 8270, and metals by Method 200.7 in accordance to procedures specified in

SECTION THREE

Project Task Description

Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, Third Edition (USEPA SW-846) analytical methods for organics and inorganics. Procedures described in the NLS QA/QC Manual and project specific attachments will be followed for the completion of this project. These procedures include: analytical procedures; calibration procedures and frequencies; preventative maintenance; and, quality control checks and routines to assess precision, accuracy, and method detection limits. A copy of the NLS QA/QC Manual and project specific attachments is included in Appendix B.

3.5 DATA VALIDATION

Data reduction, evaluation, and reporting of sample results by NLS will be performed in accordance with the NLS QA/QC manual and project specific attachments included in Appendix B, and in accordance with specifications outlined in Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, Third Edition (USEPA SW-846) analytical methods for organics and inorganics.

Upon receipt of data from each laboratory, all laboratory data collected during the RI will be validated to ensure that the data are accurate and defensible. The data results will be reviewed against validation criteria. A Data Validation Report will be developed for submittal to USEPA after all data has been validated.

A complete description of data verification and data validation tasks and procedures is provided in Section 6.

3.6 QUALITY ASSURANCE ASSESSMENT

Internal QA evaluations will be conducted periodically throughout the project to ensure that usable data will be generated. Internal audits will be conducted by the QA officers from URS and NLS. A detailed description of the QA evaluation is presented in Section 5.

SECTION THREE

Project Task Description

3.7 DATA USABILITY ASSESSMENT

Analytical data generated from the OU 1 and OU 2 sampling events will be assessed against the DQOs established for these tasks. The DQO process followed the seven steps presented in Section 4.0, and established the DQOs for these tasks. Procedures to validate the data collected are included in Section 6.

3.8 PROJECT DOCUMENTS, RECORDS AND REPORTS

Field staff will keep detailed notes of field activities and results. All original documents will be retained in the project files in URS' Madison, Wisconsin office. Project documents that will be generated during these field activities will include field logbooks, well sampling forms, boring logs, well construction forms, well development forms, and chain of custody forms. Pertinent historic data and data collected during this investigation will be presented in a Remedial Action Investigation report, upon completion of all remedial action activities.

3.9 PROJECT SCHEDULE

RI/FS activities will begin with the submittal of this draft RI/FS Work Plan to the USEPA on August 22, 2003. This is after the receipt of the receipt of the General Notice on August 8, 2003 but prior to the effective date of the AOC to be negotiated between the parties.

In accordance with discussions among NSP, USEPA and the WDNR, special emphasis will be placed by USEPA to pre-approve that portion of the work plan dealing with the well installation and sampling, and Geoprobe soil sampling for OUs 1 and 2. The purpose of this pre-approval is the need to accelerate this work for it to be completed during the Fall, 2003. Accordingly, this "mini-QAPP" is submitted to USEPA for review and approval for these specific OU 1 and 2 tasks along with the draft RI/FS Work Plan. The USEPA has agreed to accelerate the review of this QAPP to accommodate the Fall 2003 sampling schedule objective.

Subject to schedule adjustments negotiated in the context of the AOC/SOW discussions, following review of the remainder of the draft RI/FS Work Plan, a Final RI/FS Work Plan will be submitted to the USEPA within 15 days following receipt of USEPA's comments to this draft. The Site Management Plan, Pollution Control and Mitigation Plan, Waste Management Plan, and

SECTION THREE

Project Task Description

Health and Safety Plan will be submitted to the USEPA within 15 days of final Work Plan approval. The Quality Assurance Project Plan (for the remainder of the RI tasks), Field Sampling Plan, and Data Management Plan will be submitted to the USEPA within 30 days of final Work Plan approval. Within 30 days of approval of these Plans, the remainder of the RI activities will commence. It is estimated that RI activities for OU-1, OU-2, and OU-3 will be completed within 90 days, and activities for OU-4 will be completed within 180 days.

The Data Evaluation Summary Report will be submitted 45 days after receipt of all analytical results from the laboratory. This will be followed by the Data Validation Report, completed with 60 days of receiving all RI data. The draft Human Health and Ecological Risk Assessments will also be submitted 60 days after receipt of all lab data. The final HHRA and ERA will be submitted 30 days after receipt of USEPA's review comments on the drafts. A draft RI report will then be submitted within 120 days of the receipt of lab analyses. A Final RI report will be prepared within 30 days following the Agency review of the draft RI. The draft Remedial Alternatives Technical Memorandum will be submitted 60 days after the Final RI report. The final Remedial Alternatives Technical Memorandum will be submitted 30 days after receipt of USEPA's review comments on the draft. This will trigger if a Treatability Study is warranted. In that event, a Treatability Study work plan will be submitted 45 days after submittal of the final Remedial Alternatives Technical Memo. If no Treatability Study is performed, the Draft Feasibility Study Report will be submitted 90 days following submittal of the final Tech Memo. ~~In the event of a Treatability Study, the schedule for the FS will necessarily be developed at that~~ time. Modifications to the schedule will be made as needed. A detailed proposed schedule for all RI/FS tasks is included in Figure 5.

SECTION FOUR **Quality Objectives and Criteria for Measurement Data**

4.1 DATA QUALITY OBJECTIVES PROCESS

As described in Section 2.1, soil, groundwater, sediment, and surface water at the Site are contaminated with PAH compounds and VOCs. Inorganic compounds (metals and cyanide) have also been detected, but not at levels potentially harmful to human health and the environment. This contamination is the result of former activities completed on the NSP property, and activities completed on the Kreher Park Property. (A description of the Site and background information is also presented in Section 2.)

Any additional work will be completed in accordance with Agency approved work plans. Upon the completion of the site investigation, historic site investigation and monitoring results along with additional site characterization results will be used to evaluate potential remedial responses for operable units which have been characterized.

The seven steps of the DQO process are presented in Table 4.

4.2 MEASUREMENT PERFORMANCE CRITERIA - PARCC

The overall QA objective is to develop and implement procedures for field sampling, chain-of-custody, laboratory analysis, and reporting that will provide results that are in substantial compliance with the National Contingency Plan (NCP). Specific procedures for sampling, chain of custody, laboratory instruments calibration, laboratory analysis, reporting of data, internal quality control, audits, preventive maintenance of field equipment, and corrective action are described in other sections of this Plan and in documentation provided by each laboratory. NLS's QA/QC Manual and project specific attachments are included in Appendix B. The purpose of this section is to address the specific objectives for precision, accuracy, representativeness, completeness, and comparability related to the Ashland Lakefront Project. QA objectives for field measurements and laboratory measurement are included in Tables 5 and 6, respectively.

Trip blank, duplicate, and matrix spike samples will be analyzed to assess the quality of the data resulting from the field sampling program. Trip blanks are used to assess the potential for contamination of samples due to contaminant migration during sample shipment and storage. Duplicate samples are analyzed to check for sampling and analytical reproducibility. Matrix spikes

SECTION FOUR **Quality Objectives and Criteria for Measurement Data**

provide information about the effect of the sample matrix on the preparative and measurement methodology. All matrix spikes are performed in duplicate and are hereinafter referred to as MS/MSD samples.

4.2.1 PRECISION

Precision is the ability to obtain the same result every time a sample is analyzed. Field precision is assessed through the collection and measurement of field duplicates at a rate of 1 duplicate per ten analytical samples.

Precision in the laboratory is assessed through the calculation of relative percent differences (RPD) and relative standard deviations (RSD) for three or more replicate samples. Laboratory precision shall be assessed through the analysis of matrix spike/matrix spike duplicate (MS/MSD) and field duplicate samples. The RPD between the matrix spike/matrix spike duplicate is calculated to compare precision DQOs. One matrix spike/matrix spike duplicate (MS/MSD) sample will be analyzed for every 20 or fewer samples. The precision requirements are specified in Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, Third Edition (USEPA SW-846) analytical methods for organics and inorganics. The sensitivities required for analyses will be the Method Detection Limits (MDLs) and Limits of Quantitation (LOQ) included in Table 2 of NLS's QA/QC Manual, a copy of which is included in Appendix B.

4.2.2 ACCURACY

Accuracy is the degree of agreement between an observed value and an acceptable reference value. Field accuracy is assessed through the use of field and trip blanks, along with adhering to all sample handling, preservation, and holding times. One volatile organic compound (VOC) trip blank consisting of distilled ultra pure water will be included along with each shipment of aqueous VOC samples.

The accuracy of an analytical method is determined from the analysis of a sample containing a known quantity (spike) of material. Matrix spikes are evaluated by analyzing a normal environmental sample along with a spike of predetermined compounds/parameters in that sample. Surrogate spike analyses will also be conducted on samples analyzed for organic

SECTION FOUR **Quality Objectives and Criteria for Measurement Data**

analysis. The accuracy of the data will be evaluated by determining the percent recovery of matrix and surrogate spike samples, where applicable. In addition, method blanks will be analyzed to ensure that contamination in the laboratory has not introduced a systematic error into the analytical results. The accuracy requirements are specified in Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, Third Edition (USEPA SW-846) analytical methods for organics and inorganics. The sensitivities required for analyses will be the Method Detection Limits (MDLs) and Limits of Quantitation (LOQ) included in Table 2 of NLS's QA/QC Manual, a copy of which is included in Appendix B.

4.2.3 REPRESENTATIVENESS

Representativeness expresses the degree to which data accurately and precisely represent a characteristic of a population, parameter variations at a sampling point, a process condition, or an environmental condition. Representativeness is a qualitative parameter that is dependent upon the proper design of the sampling program and proper laboratory protocol. The sampling network was designed to provide data representative of site conditions. During development of this network, consideration was given to past waste disposal practices, existing analytical data, physical setting and processes, and constraints inherent to the site. The rationale of the groundwater monitoring network is discussed in detail in Sections 4.1 and 5.1 of this report. (Rationale for future sampling will be discussed in work plans submitted to the Agency for approval prior to collecting samples).

Representativeness will be satisfied by insuring that the QAPP is followed, proper sampling techniques are used, proper analytical procedure are followed, and holding times of the samples are not exceeded in the laboratory. Representativeness will be assessed by the analysis of field duplicate samples.

4.2.4 COMPLETENESS

Completeness is a measure of the amount of valid data obtained from a measurement system compared to the amount of data generated. It is expected that NLS will provide data meeting QC acceptance criteria for 95 percent or more for all samples tested. Following completion of the analytical testing, the percent completeness will be calculated by the following equation:

$$\text{Completeness} = \frac{\text{\# of samples in control}}{\text{\# of samples attempted}} \times 100$$

SECTION FOUR **Quality Objectives and Criteria for Measurement Data**

4.2.5 COMPARABILITY

Comparability expresses the confidence with which one data set can be compared with another. The extent to which existing and planned analytical data will be comparable depends on the similarity of sampling and analytical methods. The procedures used to obtain the planned analytical data, as described in this QAPP, are expected to provide comparable data. These new analytical data, however, may not be directly comparable to existing data because of difference in procedures and QA objectives.

4.3 SPECIAL TRAINING REQUIREMENTS/CERTIFICATIONS

All personnel responsible for performance of field activities or anyone who will be on site within the exclusion zone are required to have completed the 40-hour OSHA HAZWOPER training course and current 8-hour refresher courses.

URS employees and subcontractors who will be on-site have HAZWOPER initial 40-hour training and refresher course documentation. No other specific training or certification will be required for the sampling activities in OU 1 and OU2 outlined in the RI/FS work plan.

4.4 DOCUMENTATION AND RECORDS

The following sections describe the documents and records that will be generated during the project.

4.4.1 Sample Collection Records

Sample collection records document that the proper sampling protocol was performed in the field. These records will include: field logbooks, soil boring logs, daily field reports, COC forms, COC seals, and COC tags. A detailed description of the sample collection records documents is provided in Section 5. A sample COC form and sample labels are included in Appendix B.

SECTION FOUR

Quality Objectives and Criteria for Measurement Data

4.4.2 QC Sample Records

The generation of QC samples such as field and trip blanks, and duplicate samples will be documented in field logbooks and on COC forms. Sample preservation will also be noted on the COC forms. Sample integrity will be noted on the COC form by the analytical laboratory.

4.4.3 Field Analysis Records

Field analysis records will include headspace vapor monitoring of soil samples, boring logs, well construction logs, well development logs, well sampling forms, and COCs. The data generated during field activities will be recorded in field logbooks and forms. The field data will be presented on final forms in the RI/FS report.

4.4.4 Fixed Laboratory Records

Laboratory specific records which will be compiled include COC records, sample receipt forms, preparation and analysis forms/logbooks, tabulated data summary forms and raw data for samples, standards, and QC samples.

4.4.5 Data Handling Records

These records document protocols used in data reduction, verification, and validation. Data reduction, evaluation, and reporting of sample results by NLS will be performed in accordance with the NLS QA/QC manual and project specific attachments included in Appendix B, and in accordance with specifications outlined in Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, Third Edition (USEPA SW-846) analytical methods for organics and inorganics.

4.5 DATA REPORTING PACKAGE FORMAT AND DOCUMENTATION CONTROL

Field documentation of data collection is described in detail in Section 5.2.

SECTION FOUR

Quality Objectives and Criteria for Measurement Data

Laboratory documentation procedures for STL are described in the NLS QA/QC manual. The analytical reports provided by NLS comprise the final results, methods of analysis, levels of reporting, surrogate recovery data, and method blank data. The format of the data will be consistent with the requirements and procedures presented in Sections 5 and 6. The final data report that will be provided by NLS will contain the following items:

- Cover Page – signed by the project manager
- Case Narrative
- Calibration summary and raw data
- Sample information
- Results to the reporting limit (RL), with RL for non-detects
- Quality Control
- Quality Assurance Methods Reference and Notes
- Chain of Custody
- Raw Data

4.6 DATA REPORTING PACKAGE ARCHIVING AND RETRIEVAL

A central project file has been established at URS' Madison, Wisconsin office. The project file will include originals or copies of all project related paperwork for technical and administrative purposes.

SECTION FIVE

QUALITY ASSURANCE PROJECT PLAN ELEMENTS

5.1 GROUNDWATER SAMPLE COLLECTION PROCEDURES

Groundwater samples will be collected from piezometers screened in the Copper Falls aquifer as described in Section 3.3 of this report. SOPs will be followed for the following sampling activities:

- Water Level Meter(s) (SOP 100);
- pH Meter (SOP 110);
- Specific Conductance Meter (SOP 120);
- Thermometer (SOP 130);
- Groundwater Sample Collection from Monitoring Wells (SOP 150);
- VOC, SVOC, and Inorganic Sample Collection (SOP 160);
- Decontamination Procedures (SOP 190);

Prior to sample collection, static water levels will be measured in all Site wells with a water level indicator. The procedures for using the water level indicator are described in Standard Operating Procedure (SOP) 100 included in Appendix A. The water level indicator will be rinsed with distilled water between wells to prevent cross-contamination between samples. Static water level measurements will be used to determine groundwater elevations, and to calculate well casing volumes for purging.

Each well will be purged with a dedicated bailer, or submersible pump. Each well will be purged until at least four times the volume of water in the well has been removed. Additionally, field measured parameters must stabilize for purging to be complete. At least three consecutive readings spaced approximately 2 minutes, or 0.5 well volumes or more apart, are within the following ranges for the following indicator parameters:

- | | |
|------------------------|--------------------------------------------------------------------------------------|
| ▪ Specific Conductance | ± 5.0 µmhos/cm for values <1000 µmhos/cm
±10.0 µmhos/cm for values >1000 µmhos/cm |
| ▪ pH | ±0.1 pH units |
| ▪ Temperature | ±0.1 °C |
| ▪ Turbidity | <5 NTUs (Optional) |
| ▪ Dissolved Oxygen | ±0.2 mg/L |

SECTION FIVE

QUALITY ASSURANCE PROJECT PLAN ELEMENTS

For low permeability formations, purging will continue until the well is dry. If time permits, the well will be allowed to recover completely and be bailed dry a second time. Purge volumes and the color, odor, and turbidity of each will be noted on field sampling forms. The condition of the well will also be recorded at the time of sample collection. The procedures for determining pH, specific conductance, and temperature are detailed in SOPs 110, 120, and 130.

To maintain clean working conditions and control the quality of the samples collected, proper equipment decontamination procedures will be followed during all field activities. For groundwater sampling, dedicated or disposable sampling equipment will be used whenever possible to minimize the potential for cross-contamination. Sampling equipment such as bottom-filling bailers, submersible pumps, and other sampling implements will be decontaminated prior to each sample collection by washing with a low phosphate detergent, rinsing with potable water, followed by rinsing with de-ionized water. Equipment will be air-dried prior to use. Cleaned equipment will be laid out on polyethylene sheeting at each sampling location to avoid potential contamination due to contact with surface soils. Decontamination procedures will be performed in accordance with SOP 190 in Appendix A.

After the wells are purged, groundwater samples will be collected with the dedicated bailer by gently lowering the bailer below the static water level. The bailer will then be removed from the well and the sample will be discharged using a bottom emptying device into pre-cleaned containers provided by the laboratory.

Samples will be submitted to NLS for VOC analysis by Method 8260, SVOC analysis by Method 8270, and metals by Method 200.7. These sample collection procedures are described in detail SOPs 150 and 160 included in Appendix A. Sample collection, containers, preservatives, laboratory analysis, and holding times are also discussed in detail below and in the QAM included in Appendix B.

5.2 DOCUMENTATION OF FIELD ACTIVITIES

Data collected during the field activities will be recorded in field logbooks by the Field Manager(s). Entries will be described in as much detail as possible so that events can be reconstructed without reliance on memory. All entries in the notebook will be made with ink.

SECTION FIVE

QUALITY ASSURANCE PROJECT PLAN ELEMENTS

Entries into the logbook will contain a variety of information regarding field activities at the Site. Each daily entry will begin with the following information:

- Date;
- Log open time;
- Title;
- Purpose and description of field activities;
- Weather;
- Field personnel; and
- Equipment used.

The sampling representative will date and sign each activity on the day completed. Corrections will be made by drawing a single line through the incorrect entry, entering the correct information, and initializing and dating the change. At the end of each day, the sampler or Field Manager will sign and enter the time after the last entry is made (log closed time).

All measurements made, photographs taken, and samples collected will be entered into the notebook. The notebook will contain a sufficient amount of information to distinguish each sample, photograph, or measurements from the others. That information will include:

-
- Project name;
 - Unique, sequential field sample number;
 - Matrix sampled (groundwater, soil, sediment, etc.);
 - Sample depth;
 - Sampling date and time;
 - Specific sample location in sufficient detail to allow re-sampling at the same location;
 - Sampling methods and/or reasons for modifications to standard operating procedures;
 - Preservation techniques, including filtration, as appropriate to sample type;
 - Analysis to be performed;
 - Significant observations made during the sampling process;
 - Results of any field measurements;
 - Photograph number, roll number, and photograph description;
 - Printed name and signature of persons performing the sampling; and
 - Date and time of shipment, number of shipping containers, samples sent, and carrier.

SECTION FIVE

QUALITY ASSURANCE PROJECT PLAN ELEMENTS

5.3 SAMPLE HANDLING

Proper field sampling documentation, and field analytical and laboratory documentation helps to ensure sample authenticity and data integrity. For soil and groundwater samples selected for laboratory analysis, the following order of analytical parameter sample fraction collection will be utilized:

1. VOCs
2. SVOCs
3. Metals

The sample numbering system for field sample collection will utilize a two letter project identification code followed by a sample code and a location code. The project location code will be NS (for NSP). The matrix code, or sample type code will be an alpha code corresponding to the sample type as follows:

GW – Groundwater
SB – Subsurface soil sample
SS – Surface soil sample
TB – Trip blank sample
FB – Field blank sample
FD – Field duplicate sample

The location code will follow the sample type code and will consist of a two to five-digit numeric or alpha-numeric code that indicates the sample location. Location codes lower than 10 will be preceded by a '0' (e.g. 01, 02, etc.). For groundwater samples, the location code will be the monitoring well number. Geoprobe soil samples, surface soil samples, field blanks, and trip blanks will use a consecutive numbering system starting at 01. For subsurface soil samples the location code will be followed by the depth of the sample. Examples of sample identification numbers would be:

- NS-GWMW10, for Site, groundwater sample from monitoring well MW-10
- NS-SBGP01 2-4 ft, for Site, subsurface soil sample from Geoprobe Boring 1 at a depth of 2-4 feet below ground surface (bgs)
- NS-SS03, for Site, surface soil sample from location number 3

SECTION FIVE

QUALITY ASSURANCE PROJECT PLAN ELEMENTS

Sample handling and custody are described in detail in Section 5.6.

5.4 CALIBRATION PROCEDURES EQUIPMENT, CONTAINERS, AND SUPPLIES

5.4.1 LABORATORY INSTRUMENT CALIBRATION PROCEDURES

For the Ashland Lakefront Project, NLS will use calibration procedures and frequency specified on pages 20 and 21 of the NLS QA/QC Manual, a copy of which is included in Appendix B. STL will use calibration procedures and frequency specified in Section 8.0 of the STL LQM, a copy of which is included in Appendix C. Along with proper maintenance, these procedures ensure optimum instrument performance and accuracy. These procedures include proper operator training and supervision; mandatory instrument performance specifications; and systematic instrument calibration, verification, and monitoring schedules. Calibration criteria will be met before sample analysis is initiated.

5.4.2 FIELD INSTRUMENTS/EQUIPMENT CALIBRATION PROCEDURES

Prior to the start of field activities, field equipment will be calibrated to ensure that it is operating correctly. Calibration refers to the checking of physical measurements of instruments against accepted standards. It also refers to determining the response function, which is the measured net signal as a function of the given analyte concentration for an analytical instrument. Both these determinations have a significant impact on data quality and will be performed on a regular basis.

Calibration policies and procedures are discussed in the individual SOPs developed for each instrument. The following SOPs are included in Appendix A:

- Water Level Meters (SOP 100).
- pH meter (SOP 110);
- Specific Conductance Meter (SOP 120); and
- Thermometer (SOP 130).

The pH meter will be calibrated through the use of two different buffer solutions which bracket the historical range of pH in the well to be sampled. The meter will be calibrated in accordance

SECTION FIVE

QUALITY ASSURANCE PROJECT PLAN ELEMENTS

with the manufacturer's specifications and SOP 110. The probe of the meter and sampling cups will be thoroughly rinsed with de-ionized water before and after use. The pH meter calibration will be checked at each well. If the meter exhibits unacceptable error (> 0.1 pH unit), it will be re-calibrated.

The specific conductance meter will be calibrated in accordance with the manufacturer's specifications and SOP 120. The specific conductance meter will be calibrated prior to use. If the meter exhibits unacceptable error ($>3\%$), it will be re-calibrated. The probe of the meter and sampling cups will be thoroughly rinsed with de-ionized water before and after use.

Calibration intervals and procedures for field instruments will be those recommended by the instrument manufacturer, unless experience indicates a shorter interval is required. When the manufacturer has not specified a calibration interval for an instrument, it will be established by the consultant. Calibration intervals for the field equipment are summarized below.

FIELD INSTRUMENT CALIBRATION AND MAINTENANCE SCHEDULE

Instrument	Scheduled Calibration
Conductivity meter	Daily
pH meter	Daily
Water level tape(s): steel, fiberglass, or electric tape	Calibrated against National Bureau of Standards Traceable Instrumentation
Thermometer	Calibrated against National Bureau of Standards Traceable Instrumentation

5.4.3 EQUIPMENT, SUPPLIES, AND CONTAINERS

The following equipment, containers, and supplies may be utilized at the Site during the field activities:

SECTION FIVE

QUALITY ASSURANCE PROJECT PLAN ELEMENTS

EQUIPMENT

Groundwater Sampling Equipment

- Disposable PVC bailers as required
- Bailer bottom emptying device
- Specific Conductance and pH meters
- Thermometer
- Water level indicator

Soil Sampling Equipment

- Scale
- Spatula

Miscellaneous Equipment and Supplies

- Decontamination supplies
- Bailer wire/rope
- Container labels
- Permanent markers/field books and forms
- Ice chests
- Preservatives/pH indicator paper
- Well Keys
- Safety supplies

SAMPLE CONTAINERS

Sample containers for all soil and groundwater samples for this project will be supplied by NLS in Crandon, Wisconsin. NLS purchases pre-cleaned, certified sample containers, which are provided to URS. Sample containers used for the collection of all aqueous samples for this project will include the following:

- 40-mL glass vials preserved with HCL for VOC analysis;
- 1-L amber glass jars (unpreserved) for SVOC analysis; and
- 500-mL plastic bottles preserved with HNO₃ for metals analysis.

SECTION FIVE

QUALITY ASSURANCE PROJECT PLAN ELEMENTS

Sample containers used for the collection of all soil samples for this project will include the following:

- 60-mL amber glass jars preserved with MeOH for VOC analysis;
- 60-mL amber glass jars (unpreserved) for SVOC analysis; and
- 60-mL plastic bottles (unpreserved) for percent solids and metals analysis

Table 7 presents the sample container, preservation and holding time requirements for each matrix and analysis.

5.5 INSTRUMENT/EQUIPMENT INSPECTIONS AND MAINTENANCE

Instrument/equipment maintenance logs will be kept and equipment will be checked prior to use to ensure it is functioning properly.

5.5.1 FIELD INSTRUMENT MAINTENANCE

The field preventative maintenance procedures and frequencies of checks are detailed in Table 8 of this QAPP. Critical spare parts include spare batteries and back-up instruments. Instruments will be maintained according to manufacturer's specifications. More frequent maintenance may be required depending on the operational performance of the instrument. Instrument maintenance logs will document the date and type of maintenance performed on a specific piece of equipment.

5.5.2 FIELD INSTRUMENT MAINTENANCE

A routine preventative maintenance program is conducted by NLS to minimize the occurrence of instrument failure and other system malfunctions. Scheduled maintenance is performed on all analytical equipment. Maintenance procedures for individual instruments are performed according to instructions in the operation manual for that instrument. Conductivity, pH, and specific ion electrodes are rinsed with reagent grade water after each use. Probes are also cleaned according to cleaning procedures in operation manuals. Analytical balances are cleaned frequently and serviced and calibrated annually by E&B Scale. Balances are checked with class S weights when they are used.

SECTION FIVE

QUALITY ASSURANCE PROJECT PLAN ELEMENTS

Preventative maintenance that cannot be performed by laboratory staff are contracted to the manufacturer's service section or to an authorized maintenance vendor. Examples of maintenance procedures and frequencies for major analytical instrumentation are summarized in Table 9.

5.6 CHAIN OF CUSTODY PROCEDURES

5.6.1 SAMPLE CUSTODY OVERVIEW

Sample custody will be regulated and maintained through chain of custody procedures. Chain of custody is the means by which the possession and handling of samples are traced from the field to the laboratory. A sample is considered to be in a person's custody if it is actually in the person's possession, it is in the person's view, or it was in the person's possession and was secured by that person in a locked location.

The field sampling representative will be personally responsible for the care and custody of samples collected until they are transferred or dispatched properly. The Project Coordinator/Quality Assurance Manager will determine whether proper custody procedures were followed during the field work, and will decide if additional samples are required. Prior to commencement of sampling, the Project Coordinator/Quality Assurance Manager will instruct the sampling team in the chain-of-custody procedures.

Samples will be accompanied by a chain-of-custody record at all times. When transferring the possession of samples, the individuals relinquishing and receiving will sign, date, and note the time on the record. The record will document sample custody transfer from the sampler, often through another person, to the sample custodian and analyst at the laboratory. The minimum information recorded on the chain-of-custody record, in addition to the signatures and dates of all custodians, will include:

- Project identification;
- Sampling date and time;
- Identification of sample collector;
- Sample identification;
- Sample description (type and quantity); and

SECTION FIVE

QUALITY ASSURANCE PROJECT PLAN ELEMENTS

- Analyses to be performed.

5.6.2 SAMPLE CUSTODY IN THE FIELD

Field personnel will be responsible for the custody of the samples from the time they are collected until they are transferred to the sample carrier for shipment. Personnel handling the samples will be kept to a minimum to minimize transfers.

Each sample collected will be identified with a unique sample number. Sample identification information will be printed on a self-sticking sample container label affixed to the container. The sample label will contain the sample ID number, date collected, time of collection, site name, sample location (i.e., well number), sample date, analytes of interest, preservatives, and other pertinent information. Labels will be completed using indelible ink. After labels are filled out completely, labels will be covered with clear tape. The sample number, location, media type, observations, preservatives, and other sampling information will be recorded in the field book or on the appropriate sampling form.

Samples will be placed in a thermal chest on ice immediately after sample collection. The chest will remain in the sampler's view or will be locked in a secure location at all times prior to transport to a laboratory. Prior to laboratory transfer, samplers will prepare and package samples in accordance with the following procedures:

- Fill out chain of custody form completely and accurately;
- Check each of the sample bottle caps to ensure that each cap is secure;
- Rinse the outside of the sample bottles using de-ionized water to remove residual dirt, if necessary;
- Place each sample container in a sealable zip-lock bag of appropriate size and secure with strapping tape;
- Place sample bottles in the cooler in an upright position;
- Ensure that glass sample containers do not touch;
- Place inert packaging materials under, around, and above sample bottles to ensure that the containers are not broken during shipment;
- Completely cover sample bottles with ice to ensure samples are preserved at the proper temperature (4°C) upon arrival at the laboratory;
- Put paper work (chain of custody) in a sealable plastic bag and tape it inside the lid of the cooler;

SECTION FIVE

QUALITY ASSURANCE PROJECT PLAN ELEMENTS

- Obtain copies of the chain of custody for project file prior to securing lid;
- Secure lid by taping with strapping tape.
- Wrap cooler completely with strapping tape in at least two places (do not cover labels); and
- Attach completed shipping label to top of cooler, and place "This side up" and "Fragile" labels on cooler.

Samples will be packaged properly for shipment and dispatched to the laboratory. A separate chain-of-custody record will accompany each cooler. Shipping containers will be sealed for shipment to the laboratory. The method of shipment, courier name(s) and other pertinent information will be entered in the "remarks" box. The last copy of the form will be removed and retained. The original and remaining copies will be placed inside a plastic zip-lock bag taped to or placed at the top of the container. After the container is closed, the container will be sealed by wrapping it with a minimum of two complete wraps of strapping tape. The samples will be shipped by overnight carrier or picked up by the laboratory daily, or as often as necessary to ensure that samples meet holding times. The sample shipping receipt will be retained as part of the permanent chain of custody documentation.

5.6.3 LABORATORY CHAIN OF CUSTODY PROCEDURES

The laboratory sample custodian will receive and document all sample submittals into the laboratory. The sample custodian will immediately inspect the condition, preservation, temperature, and accompanying documentation of all submitted samples prior to approval and formal acceptance into the laboratory. Any problems will be immediately reported to the laboratory Project Manager. Any sample preservation or documentation discrepancies (e.g broken sample containers, improper preservation, inadequate sample volume, poor documentation, etc.) will be resolved before the sample is approved and actually accepted for analysis. The laboratory custodian will then complete all appropriate lab tracking sheets and logs, and sign and date the chain-of-custody.

5.6.4 PROJECT FILE CUSTODY PROCEDURES

Project files originating in the laboratory will be maintained in secure areas according to the following schedule:

SECTION FIVE

QUALITY ASSURANCE PROJECT PLAN ELEMENTS

- Investigative report package 5 years
- Laboratory generated records 5 years
- Electronically stored data 1 year.

5.7 COLLECTION OF QUALITY CONTROL SAMPLES

It is important to have an adequate number of field and trip blanks, duplicate, and matrix spike samples to meet quality control requirements. The specific types of quality control samples for the soil and groundwater sampling program are described as follows:

Field Blanks

A field blank, or equipment blank, is a sample of reagent-grade water which is processed through the sampling equipment in the same manner as the actual sample to determine if field cleaning procedures are adequate. Because one dedicated bailer per well will be used, no field blanks will be collected.

Trip Blanks

Trip blanks are provided by the laboratory and sent along with each sampling kit to the Site. These samples generally consist of a set of VOC vials which have been prepared with reagent-grade water at the laboratory. Trip blanks are kept on-site with the sample bottles throughout the sampling program, are never opened, and are submitted to the laboratory with the other samples. The purpose of the trip blank is to determine if any of the sample bottles or collected samples have been contaminated before or during sampling or shipping. One trip blank will be submitted with each cooler containing groundwater samples for VOC analysis that is shipped to the laboratory. Trip blanks are submitted for analysis of VOC's only.

Field Duplicates

A field duplicate is a sample taken to determine variability in the sampling procedure. Field duplicates are generally collected for any type of water quality parameters but can also be collected for soil media.

SECTION FIVE

QUALITY ASSURANCE PROJECT PLAN ELEMENTS

Duplicates are collected by splitting the sample between two sets of containers at the time of sample collection. This is done by filling a portion of each sample bottle alternating from one to the other until both are filled. This type of sampling attempts to provide a "duplicate sample" for analysis which provides additional data for comparative purposes.

A sample batch is considered to be any single group of samples that is sent to the analytical laboratory. Each duplicate sample will be collected for the suite of analyses originally designated for the sample that is split.

5.8 LABORATORY ANALYSIS

All soil and groundwater samples will be analyzed for metals, volatile organic compounds (VOCs) and semi-volatile organic compounds (SVOCs). Metals will be analyzed by Method 200.7., VOCs will be analyzed by Method 8260, and SVOCs by Method 8270 in accordance to procedures specified in Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, Third Edition (USEPA SW-846) analytical methods for organics and inorganics. Volatile organic compounds include the following:

Benzene
sec-Butylbenzene
Ethylbenzene
Styrene
Toluene
1,2,4-Trimethylbenzene
1,3,5-Trimethylbenzene
Total Xylenes

Semi-volatile organic compounds include the following:

Acenaphthene
Acenaphthylene
Anthracene
Benzo(a)Anthracene
Benzo(a)Pyrene
Benzo(e)Pyrene
Benzo(b)Fluoranthene
Benzo(k)Fluoranthene

Fluorene
Indeno(1,2,3-c,d)Pyrene
1-Methylnaphthalene
2-Methylnaphthalene
Naphthalene
Phenanthrene
Pyrene
Dibenzofuran

SECTION FIVE

QUALITY ASSURANCE PROJECT PLAN ELEMENTS

Benzo (ghi)Perylene
Chrysene
Dibenzo(a,h) Anthracene
Fluoranthene

Phenol
2-Methyl Phenol
3-Methyl Phenol
4-Methyl Phenol

Inorganic compounds include the following:

Arsenic
Aluminum
Antimony
Barium
Beryllium
Cadmium
Calcium
Chromium (+3)
Chromium (+6)
Cobalt
Copper
Cyanide
Iron

Lead
Magnesium
Manganese
Mercury
Nickel
Potassium
Selenium
Silver
Sodium
Thallium
Vanadium
Zinc

All soil and groundwater samples will be submitted to NLS for analyses. Procedures described in the NLS QA/QC Manual and project specific attachments will be followed for the completion of this project. These procedures include: analytical procedures; calibration procedures and frequencies; preventative maintenance; and, quality control checks and routines to assess precision, accuracy, and method detection limits. A copy of the NLS QA/QC Manual and project specific attachments is included in Appendix B. (Examples of forms used in Level 4 data submittal are included in Attachments 1 through 3 of Appendix B.)

SECTION SIX

DATA ASSESSMENT AND OVERSIGHT

6.1 DATA ASSESSMENT AND OVERSIGHT

Assessments will be performed periodically throughout the project to ensure that usable data will be generated. Internal audits will be conducted by the QA officers from URS and the contract laboratory.

6.1.1 FIELD SAMPLING TECHNICAL SYSTEM AUDIT (TSA)

The URS Field Team Leader will conduct an audit of field activities, covering both sampling and measurements. The audit will be performed at the start of field sampling activities and on the first day of any subsequent mobilizations so that effective corrective action measures can be implemented prior to field work being completed to mitigate any identified non-conformances. The audit will examine sample collection equipment, instrumentation including calibration procedures, availability of supplies and backup equipment, sampling procedures, COC and sample tracking, and field log books.

6.1.2 DATA PACKAGE TSA

The data package TSA is a limited review of the complete data package deliverable generated by the laboratory to ensure that all required deliverables are provided and contain all information required. The review of the completeness of the data package will assess if all items specified in the QAPP are present. All summary tables and figures will be checked for errors with the original data reports prior to including them in final reports.

6.1.3 FINDINGS AND CORRECTIVE ACTION RESPONSES

Deviations and project deficiencies that are identified will be addressed in an issue specific manner. The corrective action responses will be implemented at the time the problem is identified. The first level of notification will be to alert the URS Project Manager, with subsequent notification of the WDNR and EPA Project Managers. Implementation of corrective actions will be confirmed via project memorandum to all Project Managers, and will be documented in the field logbook, as appropriate.

SECTION SEVEN

DATA VERIFICATION AND VALIDATION

7.1 DATA REDUCTION, REPORTING, AND VALIDATION

7.1.1 DATA REDUCTION

Raw data from field measurements and sample collection activities will be appropriately recorded in the field notebook. If the data are to be used in the project reports, they will be reduced and summarized and the method of reduction will be documented in the report.

Data reduction, evaluation, and reporting of sample results by NLS will be performed in accordance with the NLS QA/QC manual and project specific attachments included in Appendix B, and in accordance with specifications outlined in Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, Third Edition (USEPA SW-846) analytical methods for organics and inorganics.

7.1.2 DATA REPORTING

The laboratory will prepare and submit complete reports to the URS Project Manager to include the following:

1. Narrative including statement of samples received, description of any deviations from procedures, explanation of qualifications regarding data quality, and any other significant problems encountered during analysis;
2. An inorganic and organic sample data package;
3. Calibration data associated with sample analyses; and
4. Field and laboratory chain-of-custody documentation pertaining to each sample delivery group analyzed.

All data generated will be tabulated in a format organized to facilitate data review and evaluation.

SECTION SEVEN

DATA VERIFICATION AND VALIDATION

7.1.3 DATA USABILITY

Data usability assessment is the process of evaluating verified/validated data to determine if they can be used to make an environmental decision. Data usability includes the following sequence of evaluation:

- Individual data sets are evaluated to identify the measurement performance/usability issues or problems affecting the ultimate achievement of DQOs;
- An overall evaluation of all data generated for the project is performed;
- Finally, the project-specific measurement performance criteria and data verification/validation criteria documented in the QAPP are evaluated to determine if they were appropriate for meeting project DQOs.

To facilitate the data usability assessment, the reported data will be supported by complete data packages which will include sample receipt and tracking information, COC records tabulated data summary forms, and raw analytical data for all field samples, standards, QC checks and QC samples, and all other project specific documents that have been generated.

7.1.4 DATA VALIDATION

Upon receipt of data from the laboratory, all laboratory data collected during the RI will be validated to ensure that the data are accurate and defensible. The data results will be reviewed against validation criteria. A Data Validation Report will be developed for submittal to USEPA after all data has been validated.

All sampling, handling, field analytical data and NLS data will be validated by URS. The validation procedure will specify the validation process of every QC measure used in the field and laboratory. All NLS data packages will be reviewed for compliance with the applicable analytical method for the quality of the data reported.

The data package contents will comply with US EPA Contract Laboratory Program (CLP) list of deliverables. Data validation of the assembled data packages will be done in accordance with *USEPA Contract Laboratory Program National Functional Guidelines for Organic Data Review*, Publication 9240.1-05A, EPA-540/IR-99/008, October 1999; and *USEPA Contract*

SECTION SEVEN

DATA VERIFICATION AND VALIDATION

Laboratory Program National Functional Guidelines for Inorganic Data Review, Publication 9240.1-05-01, EPA-540/R-94/013, PB94-963502, February, 1994; and the most current EPA Region V Standard Operating Procedures for validation of CLP organic (November 2002) and inorganic data (September 1993 or later). Compliance of the data against the laboratory SOPs, EPA reference method and data validation criteria will be done for the data packages as specified by URS.

7.2 DATA MANAGEMENT PLAN

~~Data management is the process of organizing, maintaining, and applying a variety of data to provide a useful and coherent view of the site conditions. A data management plan provides the policies and procedures regarding data documentation, control, storage, and management of data.~~

For the Ashland Lakefront project, data will be generated from environmental sampling and laboratory analysis activities. Sampling activities will be documented by recording details of completed activities in field log books, on field data record forms (soil boring logs, well construction forms, well development forms, well/borehole abandonment forms, and groundwater monitoring forms), and on sample chain-of-custody records. Procedures are documented in detail in section 5.2 of this report. Laboratory activities completed by NLS will be documented as described in the NLS QA/QC Manual and project specific Attachments included in Appendix B. Laboratory activities completed by STL will be documented as described in the STL LQM and laboratory SOPs included in Appendix C.

Data control is a systematic procedure for ensuring that all sampling/monitoring documents are identified and accounted for during and after the project. Document control procedures will include document inventory and storage. This will be accomplished by placing all original copies of data documentation in a project job file to be held in file cabinets for the duration of the project. Project documentation will include three general categories of information:

1. Category 1 data includes general administrative documents, such as project memos, meeting notes and records of telephone and other conversations.

SECTION SEVEN

DATA VERIFICATION AND VALIDATION

2. Category 2 data includes technical documentation which is not directly associated with sampling, and laboratory analyses, such as field logbooks, field memos, computation forms, project deliverables, and miscellaneous communications; and,
3. Category 3 data includes technical documentation which is directly associated with sampling, and laboratory analyses, such as survey documentation, field data records, chain-of-custody records, laboratory analytical results, and QA/QC data.

All documents will be managed by the Project Manager. Access to original data will be limited to URS staff working on the project. When access to documents is required by others, copies will be provided, and the copies will be clearly stamped "COPY".

TABLES

Table 1 (Page 1 of 2)
Summary of Constituents of Concern - Soil
Ashland/NSP Lakefront Superfund Site

Analytical Parameters				
	PRG (mg/kg) dry wt.	Protection Pathway	Source of PRG	Target Lab DL (mg/kg)
SVOCs				
*Acenaphthene	38	GW	WDNR Soil Cleanup Levels for PAHs Interim Guidance (April 1997)	0.330
*Acenaphthylene	0.7	GW		0.070
*Anthracene	3,000	GW		0.330
*Benzo(a)Anthracene	0.088	DC		0.0088
*Benzo(a)Pyrene	0.0088	DC		0.00088
*Benzo(e)Pyrene				0.330
*Benzo(b)Fluoranthene	0.088	DC		0.0088
*Benzo(k)Fluoranthene	0.88	DC		0.088
*Benzo(g,h,i)Perylene	1.8	DC		0.180
*Chrysene	8.8	DC		0.330
*Dibenzo(a,h)Anthracene	0.0088	DC		0.00088
*Fluoranthene	500	GW		0.330
*Fluorene	100	GW		0.330
*Indeno(1,2,3-cd)Pyrene	0.088	DC		0.0088
1-Methyl Naphthalene	23	GW		0.330
*2-Methyl Naphthalene	20	GW		0.330
*Naphthalene	0.4	GW		0.040
*Phenanthrene	18	GW		0.330
*Pyrene	500	DC		0.330
*Total PAHs (dry wt.)				
*Dibenzofuran				0.330
*Phenol				0.330
2-Methyl Phenol				0.330
3-Methyl Phenol				0.330
4-Methyl Phenol				0.330
Inorganics				
*Arsenic	0.039	DC	NR 720.11	0.0039
Aluminum				40
Antimony				12
Barium				40
Beryllium				1.0
Cadmium	8.0	DC	NR 720.11	0.80
Calcium				1000
Chromium(+3) ²	16,000	DC	NR 720.11	2.0
Chromium(+6) ²	14	DC	NR 720.11	1.4
Cobalt				10
Copper		DC		5.0
Cyanide				1.0
Iron				20
*Lead	50	DC	NR 720.11	2.0

Table 1 (Page 2 of 2)
Summary of Constituents of Concern - Soil
Ashland/NSP Lakefront Superfund Site

Analytical Parameters				
	PRG (mg/kg) dry wt.	Protection Pathway	Source of PRG	Target Lab DL (mg/kg)
Magnesium				1000
Manganese				3.0
Mercury				0.10
Nickel				8.0
Potassium				1000
Selenium				7.0
Silver				2.0
Sodium				1000
Thallium				5.0
Vanadium				10
Zinc				12
VOCs				
*Benzene	0.0055	GW	NR 720.09	0.00055
*sec-Butylbenzene				
*Ethylbenzene	2.9	GW	NR 720.09	0.010
Styrene				0.010
*Toluene	1.5	GW	NR 720.09	0.010
*1,2,4-Trimethylbenzene ¹				0.010
*1,2,3-Trimethylbenzene ¹				0.010
*Total Xylenes	4.1	GW	NR 720.09	0.010

- * Chemicals with an asterisk next to the name are those which demonstrated risk at the site in at least some situations
- DC Protection from direct contact
- DCBSQG Draft WDNR Draft Consensus Based Sediment Quality Guidelines (Version January 2002).
- GW Protection of groundwater
- NR Natural Resources Wisconsin Administrative Code
- WDNR/EPA Based on project specific discussions between WDNR and EPA
- Total PAHs is the sum of the 19 individual PAH listed above
- 1 PRG for total trimethylbenzenes in groundwater = 480 ug/L
- 2 PRG for total chromium in groundwater = 100 ug/L; PRG for total chromium in sediments = 43 mg/kg

Table 2 (Page 1 of 2)
Summary of Constituents of Concern - Groundwater
Ashland/NSP Lakefront Superfund Site

Analytical Parameters			
	PRG (ug/l)	Source of PRG	Target Lab DL (ug/l)
SVOCs			
*Acenaphthene			10.0
*Acenaphthylene			10.0
*Anthracene	3,000	NR 140.10	10.0
*Benzo(a)Anthracene			10.0
*Benzo(a)Pyrene	0.2	NR 140.10	0.020
*Benzo(e)Pyrene			10.0
*Benzo(b)Fluoranthene	0.2	NR 140.10	0.020
*Benzo(k)Fluoranthene			10.0
*Benzo(g,h,i)Perylene			10.0
*Chrysene	0.2	NR 140.10	0.020
*Diben(a,h)Anthracene			10.0
*Fluoranthene	400	NR 140.10	10.0
*Fluorene	400	NR 140.10	10.0
*Indeno(1,2,3-cd)Pyrene			10.0
1-Methyl Naphthalene			10.0
*2-Methyl Naphthalene			10.0
*Naphthalene	40	NR 140.10	10.0
*Phenanthrene			10.0
*Pyrene	250	NR 140.10	10.0
*Total PAHs (dry wt.)			
*Dibenzofuran			10.0
*Phenol	6,000	NR 140.10	10.0
2-Methyl Phenol			10.0
3-Methyl Phenol			10.0
4-Methyl Phenol			10.0
Inorganic			
*Arsenic	50	NR 140.10	1.0
Aluminum			30
Antimony	6	NR 140.10	0.6
Barium	2,000	NR 140.10	10
Beryllium	4	NR 140.10	0.4
Cadmium	5.0	NR 140.10	0.50
Calcium			5000
Chromium(+3) ²	100	NR 140.10	2.0
Chromium(+6) ²	100	NR 140.10	2.0
Cobalt	40	NR 140.10	0.50
Copper	1,300	NR 140.10	2.0
Cyanide	200	NR 140.10	10
Iron	300	NR 140.12	30

Table 2 (Page 2 of 2)
Summary of Constituents of Concern – Groundwater
Ashland/NSP Lakefront Superfund Site

Analytical Parameters	Groundwater		
	PRG (ug/l)	Source of PRG	Target Lab DL (ug/l)
*Lead	15	NR 140.10	1.0
Magnesium			5000
Manganese	50	NR 140.12	0.50
Mercury	2	NR 140.10	0.20
Nickel	100	NR 140.10	1.0
Potassium			5000
Selenium	50	NR 140.10	5.0
Silver	50	NR 140.10	1.0
Sodium			5000
Thallium	2	NR 140.10	0.2
Vanadium	30	NR 140.10	1.0
Zinc	500	NR 140.12	1.0
VOCs			
*Benzene	5	NR 140.10	0.50
*sec-Butylbenzene			
*Ethylbenzene	700	NR 140.10	10
Styrene	100	NR 140.10	10
*Toluene	1,000	NR 140.10	10
*1,2,4-Trimethylbenzene ¹	480	NR 140.10	10
*1,2,3-Trimethylbenzene ¹	480	NR 140.10	10
*Total Xylenes	10,000	NR 140.10	10

* Chemicals with an asterisk next to the name are those which demonstrated risk at the site in at least some situations

DC Protection from direct contact
DCBSQG Draft WDNR Draft Consensus Based Sediment Quality Guidelines (Version January 2002).
GW Protection of groundwater
NR Natural Resources Wisconsin Administrative Code
WDNR/EPA Based on project specific discussions between WDNR and EPA
Total PAHs is the sum of the 19 individual PAH listed above

1 PRG for total trimethylbenzenes in groundwater = 480 ug/L
2 PRG for total chromium in groundwater = 100 ug/L; PRG for total chromium in sediments = 43 mg/kg

Table 3
Summary of Sampling and Analysis Program
Ashland/NSP Lakefront Superfund Site

Sample Matrix	Field Parameters	Laboratory Parameters	Sample No.	Field Duplicate	Field Blanks	MS/MSD ^{1,2}	Matrix ³
Groundwater	Temperature pH Conductivity	VOCs	7	1	1	1	9
		SVOCs	7	1	1	1	9
		Metals	7	1	1	--	9
Subsurface Soil	Soil Gas Screening w/ PID	VOCs	81	5	--	--	86
		SVOCs	81	5	--	--	86
		Metals	81	5	--	--	86
Surface Soil	Soil Gas Screening w/ PID	VOCs	12	2	--	--	14
		SVOCs	12	2	--	--	14
		Metals	12	2	--	--	14

The field quality control samples also include trip blanks, which are required for VOC water samples. One trip blank, which consists of two preserved 40-ml vials is shipped with each shipping cooler of VOC vials.

1. Additional volume is required for MS/MSD samples for organic water analysis. Samples designated for MS/MSD analysis will be collected, with extra sample volume, at a frequency of one per group of 20 or fewer investigative samples. Triple the normal sample volumes will be collected for VOCs, and double the normal sample volumes will be collected for semivolatiles
2. For inorganic analysis, no extra sample volume is required
3. The number of trip blanks and the number of samples to be collected for MS/MSD are not included in the matrix total

Table 4
DQO Steps for OU-1 and OU-2 Remedial Investigation
Ashland/NSP Lakefront Superfund Site

Step 1	Step 2	Step 3	Step 4	Step 5	Step 6	Step 7
State the Problem	Identify the Decision	Identify Inputs to the Decision	Define Study Boundaries	Develop Decision Rules	Specify Limits on the Decision Errors	Optimize Sampling Design
A defined vertical and horizontal extent of contamination in the soil and groundwater is needed in OU 1 and OU 2 with respect to PRG values for the site.	What are both the horizontal and vertical extents of contamination in OU 1 and OU 2 with respect to PRG values for the site?	Validated defensible VOC, SVOC and metals analyses with sufficiently low detection limits to correspond to PRG values.	Soil samples will be collected from Geoprobe borings for analysis at a rate of 1 per 10 feet and analyzed for select VOCs, SVOCs and metals.	If chemical data passes validation assessment and data detection limits are less than PRGs, then data set will be accepted for OU characterization.	Data validation will use specified evaluation criteria. Comparison of validated data will be against specified PRG values that have been agreed to by the regulatory agencies.	<p>37 Geoprobe borings will be advanced a minimum of five feet below the base of the filled ravine, or to a maximum depth of 20 feet. The borings will be located as shown on Figure 4.</p>
			Additional subsurface soil samples will also be collected from Geoprobe borings to evaluate background conditions. Samples will be collected and analyzed for select VOCs, SVOCs and metals.			
			Surface soil samples will be collected from unpaved areas around the former MGP facility. Groundwater samples will be collected from existing and new monitoring wells and piezometers and analyzed for select VOCs, SVOCs and metals.			<p>3 Geoprobe borings will be advanced up gradient of the fill ravine. Seven soil samples will be selected for analysis. The borings will be located as shown on Figure 4.</p> <p>Twelve surface soil samples will be collected at various locations around the property. The locations are shown on Figure 4.</p>
						An additional seven piezometers will be installed as shown on Figure 4.

Step 1	Step 2	Step 3	Step 4	Step 5	Step 6	Step 7
State the Problem	Identify the Decision	Identify Inputs to the Decision	Define Study Boundaries	Develop Decision Rules	Specify Limits on the Decision Errors	Optimize Sampling Design
<p>The extent of DNAPL in each OU needs to be defined</p> <p>The contaminant migration pathways and fate and transport of contaminants needs to be defined.</p>	What is extent of DNAPL in the groundwater?	Validated water level and DNAPL measurements.	Collect water level and DNAPL measurements from all existing and proposed monitoring wells and piezometers.	If data passes validation assessment, then data set will be accepted for OU characterization.	Data validation will use specified evaluation criteria.	Collect water level and DNAPL measurements from all existing and proposed monitoring wells and piezometers.
	What are the contaminant migration pathways and fate and transport of contaminants?	Validated defensible VOC, SVOC and metals analyses with sufficiently low detection limits to correspond to PRG values.	<p>Soil samples will be collected from Geoprobe borings for analysis at a rate of 1 per 10 feet and analyzed for select VOCs, SVOCs and metals.</p> <p>Additional subsurface soil samples will also be collected from Geoprobe borings to evaluate background conditions. Samples will be collected and analyzed for select VOCs, SVOCs and metals.</p>	If data passes validation assessment, then data set will be accepted for pathway and fate and transport characterization.	Data validation will use specified evaluation criteria.	<p>37 Geoprobe borings will be advanced a minimum of five feet below the base of the filled ravine, or to a maximum depth of 20 feet. The borings will be located as shown on Figure 4.</p>
			<p>Surface soil samples will be collected from unpaved areas around the former MGP facility.</p> <p>Groundwater samples will be collected from existing and new monitoring wells and piezometers and analyzed for select VOCs, SVOCs and metals.</p>			<p>3 Geoprobe borings will be advanced up gradient of the fill ravine. Seven soil samples will be selected for analysis. The borings will be located as shown on Figure 4.</p> <p>Twelve surface soil samples will be collected at various locations around the property. The locations are shown on Figure 4.</p> <p>An additional seven piezometers will be installed as shown on Figure 4.</p>

Step 1	Step 2	Step 3	Step 4	Step 5	Step 6	Step 7
State the Problem	Identify the Decision	Identify Inputs to the Decision	Define Study Boundaries	Develop Decision Rules	Specify Limits on the Decision Errors	Optimize Sampling Design
<p>The extent of DNAPL in each OU needs to be defined</p> <p>The contaminant migration pathways and fate and transport of contaminants needs to be defined.</p>	What is extent of DNAPL in the groundwater?	Validated water level and DNAPL measurements.	<p>Collect water level and DNAPL measurements from all existing and proposed monitoring wells and piezometers.</p>	<p>If data passes validation assessment, then data set will be accepted for OU characterization.</p>	<p>Data validation will use specified evaluation criteria.</p>	<p>Collect water level and DNAPL measurements from all existing and proposed monitoring wells and piezometers.</p>
	What are the contaminant migration pathways and fate and transport of contaminants?	Validated defensible VOC, SVOC and metals analyses with sufficiently low detection limits to correspond to PRG values.	<p>Soil samples will be collected from Geoprobe borings for analysis at a rate of 1 per 10 feet and analyzed for select VOCs, SVOCs and metals.</p> <p>Additional subsurface soil samples will also be collected from Geoprobe borings to evaluate background conditions. Samples will be collected and analyzed for select VOCs, SVOCs and metals.</p>	<p>If data passes validation assessment, then data set will be accepted for pathway and fate and transport characterization.</p>	<p>Data validation will use specified evaluation criteria.</p>	<p>37 Geoprobe borings will be advanced a minimum of five feet below the base of the filled ravine, or to a maximum depth of 20 feet. The borings will be located as shown on Figure 4.</p>
			<p>Surface soil samples will be collected from unpaved areas around the former MGP facility.</p> <p>Groundwater samples will be collected from existing and new monitoring wells and piezometers and analyzed for select VOCs, SVOCs and metals.</p>			<p>3 Geoprobe borings will be advanced up gradient of the fill ravine. Seven soil samples will be selected for analysis. The borings will be located as shown on Figure 4.</p> <p>Twelve surface soil samples will be collected at various locations around the property. The locations are shown on Figure 4.</p>
						<p>An additional seven piezometers will be installed as shown on Figure 4.</p>

Step 1	Step 2	Step 3	Step 4	Step 5	Step 6	Step 7
State the Problem	Identify the Decision	Identify Inputs to the Decision	Define Study Boundaries	Develop Decision Rules	Specify Limits on the Decision Errors	Optimize Sampling Design
Chemical data is needed to conduct human health and ecological risk assessments.	What are the most critical areas in OUs 1 & 2 to gather data for human health and ecological risk assessments?	Validated defensible VOC, SVOC and metals analyses with sufficiently low detection limits to correspond to PRG values.	<p>Soil samples will be collected from Geoprobe borings for analysis at a rate of 1 per 10 feet and analyzed for select VOCs, SVOCs and metals.</p> <p>Additional subsurface soil samples will also be collected from Geoprobe borings to evaluate background conditions. Samples will be collected and analyzed for select VOCs, SVOCs and metals.</p> <p>Surface soil samples will be collected from unpaved areas around the former MGP facility.</p> <p>Groundwater samples will be collected from existing and new monitoring wells and piezometers and analyzed for select VOCs, SVOCs and metals.</p>	If data passes validation assessment, then data set will be accepted for risk assessments.	<p>Data validation will use specified evaluation criteria.</p> <p>37 Geoprobe borings will be advanced a minimum of five feet below the base of the filled ravine, or to a maximum depth of 20 feet. The borings will be located as shown on Figure 4.</p> <p>3 Geoprobe borings will be advanced up gradient of the fill ravine. Seven soil samples will be selected for analysis. The borings will be located as shown on Figure 4.</p> <p>Twelve surface soil samples will be collected at various locations around the property. The locations are shown on Figure 4.</p> <p>An additional seven piezometers will be installed as shown on Figure 4.</p>	Optimize Sampling Design

Step 1	Step 2	Step 3	Step 4	Step 5	Step 6	Step 7
State the Problem	Identify the Decision	Identify Inputs to the Decision	Define Study Boundaries	Develop Decision Rules	Specify Limits on the Decision Errors	Optimize Sampling Design
Chemical data is necessary to evaluate potential Remedial Alternatives.	What are the potential remedial alternatives?	Validated defensible VOC, SVOC and metals analyses with sufficiently low detection limits to correspond to PRG values.	<p>Soil samples will be collected from Geoprobe borings for analysis at a rate of 1 per 10 feet and analyzed for select VOCs, SVOCs and metals.</p> <p>Additional subsurface soil samples will also be collected from Geoprobe borings to evaluate background conditions. Samples will be collected and analyzed for select VOCs, SVOCs and metals.</p> <p>Surface soil samples will be collected from unpaved areas around the former MGP facility.</p> <p>Groundwater samples will be collected from existing and new monitoring wells and piezometers and analyzed for select VOCs, SVOCs and metals.</p>	If data passes validation assessment, then data set will be accepted for use in determining remedial alternatives.	Data validation will use specified evaluation criteria.	<p>37 Geoprobe borings will be advanced a minimum of five feet below the base of the filled ravine, or to a maximum depth of 20 feet. The borings will be located as shown on Figure 4.</p> <p>3 Geoprobe borings will be advanced up gradient of the fill ravine. Seven soil samples will be selected for analysis. The borings will be located as shown on Figure 4.</p> <p>Twelve surface soil samples will be collected at various locations around the property. The locations are shown on Figure 4.</p> <p>An additional seven piezometers will be installed as shown on Figure 4.</p>

Table 5
QA Objectives for Field Measurements
Ashland/NSP Lakefront Superfund Site

Parameter	Method Reference	Precision	Accuracy	Completeness
Standing Water Levels	Solinst	± 0.01 ft.	0.005 ft.	95%
Monitoring Well Water Temperature	E170.1, Electronic Temperature Probe	± 0.5 degrees C	1.0 degrees C	95%
Conductivity	E120.1, Electrometric	± 25	10 uhmo/cm ²	95%
pH	E150.1, Electrometric	± 0.1 pH units	0.05 pH units	95%
Turbidity	E180.1	10 NTU	0.5 NTU	95%
Dissolved Oxygen	ASTM - A4500	± 0.05 mg/L	± 0.1 mg/L	95%

Table 6
QA Objectives for Laboratory Measurements
Ashland/NSP Lakefront Superfund Site

Matrix Spike Recovery and Relative Percent Difference Limits				
	% Recovery		%RPD	
	Water	Soil	Water	Soil
VOCs				
1,1- Dichloroethene	61-145	67-112	14	29
Trichloroethene	74-126	59-140	22	29
Benzene	76-127	77-115	18	23
Toluene	71-132	79-120	19	21
Chlorobenzene	83-120	85-109	15	14
SVOCs				
Phenol	24-62	26-120	23	39
2-Chlorophenol	37-100	36-109	23	24
1,4 – Dichlorobenzene	45-94	42-103	22	21
N-Nitroso-di-N-propylamine	50-103	23-126	22	22
1,2,4 – Trichlorobenzene	56-99	34-117	23	35
4-Chloro-3-Methylphenol	52-109	50-116	20	26
Acenaphthene	67-110	56-117	18	21
4-Nitrophenol	0-67	0-136	86	46
2,4-Dinitrotoluene	63-112	44-123	18	21
Pentachlorophenol	0-106	4-136	79	34
Pyrene	67-113	51-114	18	27

Table 7
Sample Container Preservation and Holding Time Requirements
Ashland/NSP Lakefront Superfund Site

Matrix	Analysis	Container	Preservation	Holding Time
Groundwater	VOCs SVOCs Metals	2 40-mL glass vials 2 1-L amber glass jars 500 mL plastic bottle	HCL, cool to 4 degrees C unpreserved, cool to 4 degrees C HNO ₃	14 days 7 days until extraction 6 months
Soil	VOCs SVOCs Metals	60-mL amber glass 60-mL amber glass 60-mL plastic	MeOH, cool to 4 degrees C unpreserved, cool to 4 degrees C unpreserved, cool to 4 degrees C	14 days until extraction 14 days until extraction 6 months

Table 8
Field Equipment Preventative Maintenance Procedures and Frequencies
Ashland NSP Lakefront Superfund Site

Instrument	Maintenance Procedures/Schedule	Spare Parts
RAE Systems Mini RAE 2000 Photoionization Detector	1. Calibrate the beginning of each day and as necessary during use. 2. Check battery and recharge when low. 3. Clean lamp as needed.	1. Battery charger 2. Spare lamps
pH Meter	1. Calibrate beginning and end of each day, and as necessary during use. 2. Replace electrodes as needed.	1. Batteries 2. pH Buffers 3. Spare electrodes
Conductivity Meter	1. Calibrate beginning and end of each day, and as necessary during use. 2. Check redline and replace batteries if does not calibrate.	1. Batteries

Table 9
Preventative Maintenance for Major Analytical Equipment Preventative
Ashland NSP Lakefront Superfund Site

Instrument	Activity	Frequency
Gas Chromatograph/ Mass Spectrometer	Check vacuum manifold pressure	Daily
	Check Rough Pump Oil Level	Weekly
	Check Pressure of Carrier Gas	Weekly
	Check CAL Gas Vial	Monthly
	Refill CAL Gas Vial	As Needed
	Replace Rough Pump Oil	Every three months
	Replace Rough Pump trap Pellets	Every six months
	Check Diffusion Oil Pump	Yearly
	Replace Diffusion Oil Pump	As needed
	Clean Ion Source	As needed
Inductively coupled argon plasma emission spectrometer	Replace Oxygen Carrier Gas Trap	As needed/poor sensitivity
	Replace Filament and Multiplier	As needed/poor sensitivity
	Replace injector septa	As needed/poor sensitivity
	Replace injection port glass insert & O- ring, gold seal & washer	As needed/100 injections
	Replace Peristaltic pump tubing	As needed/poor sensitivity
	Empty Waste Carboy	Daily
	Check sample uptake lines for plugs	Daily/As needed
	Check Argon pressure	Daily
	Reset Instrument communications board	Daily
	Reset nebulizer pressure switch	Daily

APPENDIX A

URS STANDARD OPERATING PROCEDURES

**URS
STANDARD OPERATING PROCEDURES
INDEX**

100	Water Level Meter(s)
110	pH Meter
120	Specific Conductance Meter
130	Thermometer
140	Soil Sample Collection from Boreholes
150	Groundwater Sample Collection from Monitoring Wells
160	VOCs, SVOCs, and Inorganic Sample Collection
170	Filtering Groundwater for Metals
180	Equipment Blank Sampling
190	Decontamination Procedures

Note: SOPs for the collection of vapor air monitoring samples included in Appendix C.

URS
STANDARD OPERATING PROCEDURE 100
WATER LEVEL METER(S)

Page 1 of 4

1.0 SCOPE

This operating procedure describes methods for measuring and recording manual water level measurements in wells by means of an electronic or mechanical device. Water levels may be observed with steel or fiberglass tapes by a "popper" weight, which makes a popping sound when it strikes the water surface. An electrical tape may also be used which transmits and activates a sound (BEEP) in response to its electrode contact with the water surface.

2.0 OBJECTIVES

This standard procedure is intended to:

- Assure that water levels measured at different times and by different personnel are comparable, uniform, and reliable.
- Allow traceability of errors in water level measurement, and correction of improper procedures.
- Assure the data obtained in the field are complete and of satisfactory precision and accuracy.

3.0 EQUIPMENT NEEDED

- Steel, fiberglass or electrical tape. Steel or fiberglass tapes should be graduated in feet to hundredths. Electrical tapes may be graduated only at 5-foot intervals.
- Pocket steel tape or folding ruler (graduated in feet to hundredths).
- Permanent marker for marking well with its number and marking the measure point.
- Pre-printed water-level measurement forms.
- Field notebook.
- Batteries for electrical tape.
- Clean rags or Kimwipes.
- Distilled or de-ionized water; organic-free if well is to be sampled for organics.

4.0 CALIBRATION

Prior to initial use, the water level tape should be checked against a standard steel tape with calibration traceable to the National Bureau of Standards. The calibration tape should not be used for field measurements, but only for calibrating field tapes. New field tapes will be calibrated against the standard tape before use by stretching both along a flat level surface and applying to each a tension approximately equal to the weight of the tape. For each 10 feet of distance along the standard tape, record the corresponding reading of the field tape on a Tape Calibration Record.

URS
STANDARD OPERATING PROCEDURE 100
WATER LEVEL METER(S)

Page 2 of 4

5.0 MEASURING POINT

The measuring point is the fixed point on the well from which all water level measurements are taken. The selected point is generally the highest point on top of the PVC casing where the well elevation has been determined.

The measuring point must be permanently marked. Usually it will be most convenient to put a spot of permanent ink on the PVC casing rim, with an arrow and the letters "MP" pointing to it.

Experience shows that considerably more error in ground water level measurements comes from mistaking the identity of a well or the location of the proper measuring point than from errors in the actual measurement. It is essential that the well and measuring point be clearly identified. If field inspector or technician notices an unmarked well, they should make sure that the well number and measuring point location are permanently marked. The well number may be painted on the outside of the casing or inside of the protective cap, as long as it is obvious to anyone opening the well for measurement.

6.0 PRELIMINARY TO OPERATION

1. Inspect tape to make sure that is complete and moves freely in its case. Make sure that popper is firmly attached and that its lower end is a convenient distance (for example, 0.50 feet) below the zero mark on the tape. Record the distance on the field log.
2. Inspect electrode tip of electric tape. Test batteries, and test operation of tape in the laboratory by placing electrode in tap water and making sure that the meter or other indicator responds. Make sure that the effective position of the electrode corresponds to the zero position on the tape. If the electrode has been repaired or replaced, the zero position may have been affected. Note any discrepancy in the field notes and notify the laboratory manager.

7.0 CLEANING

1. Clean the tape just before each measurement.
2. Wipe the tape and/or rinse with tap water as necessary to remove any dirt.
3. Rinse the lower 5 feet of the tape with distilled or de-ionized water. If the well is to be used for organics, use organic-free water.

8.0 MEASUREMENT METHODS

Two measurement methods are described.

- Measurement with popper.

URS
STANDARD OPERATING PROCEDURE 100
WATER LEVEL METER(S)

Page 3 of 4

- Measurement with electric tape. Use of appropriate method should be determined based on the existing conditions and upon discussions with the project hydrogeologist and Quality Assurance Officer.

All water level measurements in a particular sampling round should be made using the same water level meter.

8.1 Measurement with Popper

1. This method is simple, fast, and fairly accurate. It is preferred for most measurements, particularly in shallow wells. Precision is approximately ± 0.02 feet, but may be less under unfavorable conditions. Accuracy depends on the tape used. Occasionally, conditions in the well or outside noise will make it impossible to hear the popper, and measurements with electric tape should be employed.
2. Lower the tape into the well until the hollow-bottomed weight strike the water surface and causes a popping sound. Hold the tape near the measuring point, and raise and lower several times to determine the water surface as closely as possible.
3. Record the actual number of feet that appears opposite the measuring point, i.e., do not add the "popper correction"—the distance from the tape zero mark to the bottom of the popper—before recording the number. Read the tape to the nearest ± 0.01 feet. Record the popper correction on the field log and add to the measured water depth.

8.2 Measurement with Electrical Tape

1. This method may be less accurate than the popper methods. Its precision may be limited by uncertainties in interpreting the sensing meter. Accuracy may be as low in measuring deep wells because of tape stretching. This method should be used with caution if high accuracy is important, for example in pumping tests. It may be preferred, however, in deep wells or in water table wells where other methods are not feasible, or in noisy situations.
2. Turn on the electrical water sensor. Lower the tape into the well until it produces a meter or other response. Raise and lower the tape a few times to confirm that the water level has been detected.
3. If the tape is not calibrated to ± 0.01 feet, grasp the tape across the measuring point. Record the value of the nearest calibrated point; for example, if the tape is marked at 5-foot intervals, record the value of the nearest 5-foot marker on the water-level log.

URS
STANDARD OPERATING PROCEDURE 100
WATER LEVEL METER(S)

Page 4 of 4

4. Using a pocket rule, measure and record the distance from the measuring point to the nearest marker. If the measuring point is above the marker, record this distance as positive (+), or if below as negative (-).
5. Add the two reading algebraically to obtain the depth to water.

9.0 RECORD KEEPING

Whenever possible, use pre-printed forms, since these will minimize the risk of missing some important information. If taking notes in a field log, however, the following should be recorded:

- Well number and location. All too often a single well is assigned two or more different numbers; if at all possible, record them all to avoid confusion for future users of the records.
- Date and time of measurement.
- Field observer's name.
- Serial number of tape used.
- Measuring point description, including whenever possible its sea level elevation, stickup (the distance from the ground surface to the measuring point). Be sure to note whether the measuring point is above or below ground surface.
- Method of measurement.
- Tape readings.
- Factors that may influence the water level -- for example, recent pumping of the well or nearby wells.
- Damage or alterations to the well or settlement that may have occurred since the last measurement.

As soon as possible, the measurements should be reduced in the office to elevation above sea level for long-term data storage. This is important because alteration or damage to wells changes the measuring point elevation, so that measurements of depth to water before and after this change are not comparable. The resulting confusion is difficult to sort out.

10.0 WELL SURVEY

During well survey, the surveyor should obtain elevations of both the measuring point and the ground surface. If a concrete pad surrounds a well, surveyor should also permanently mark a spot on the pad and determine its elevation. This allows easy determination of a new measuring point elevation if the well is damaged or modified.

URS
STANDARD OPERATING PROCEDURE 110
pH METER

Page 1 of 4

1.0 SCOPE

This operating procedure describes the operation, calibration, and maintenance of pH Meter and its accessories for use in the field. Manufacturer's specifications and recommendations should be followed or referred to as and when need arises.

2.0 OBJECTIVES

The activities covered by this procedure:

- Insure quality control in field pH measurement.
- Insure uniformity and continuity in operation, calibration, and maintenance of both the equipment and measuring techniques by different qualified field analysts or technicians.

3.0 EQUIPMENT NEEDED

- pH meter² and its accompanying electrode or probe.
- Buffer solutions of known pH (4.0, 7.0, and 10.0).
- Plastic or glass beakers or cups (at least 20 mL volume).
- Distilled or de-ionized water.
- Polyethylene spray bottle.
- Waterproof marking pen or pencil.
- Liquid waste container.
- Thermometer.
- Trash receptacle.
- User's manual for pH meter.

Portable pH meters available with URS for use in field include:

- Myron L pDS Meter - Model EP11/pH;
- Orion pH Meter - Model 230A;
- CSI pH/Temperature/Conductivity Tester - Catalog No. 301353;
- Orion pH Meter - Model 407A;
- Hydrolab pH Conductivity; and
- Omega pH and Conductivity Pens.

4.0 PRELIMINARY TO OPERATION

At the start of each field day, the pH meter should be examined for cleanliness, and checked for defects, and any possible need of repair. The checks should include whether the battery and electrode are operable. The meter should also be calibrated at the start of each day, with intermittent calibration checks throughout the day to determine whether recalibration is necessary. The following procedures should be performed at the start of each field day:

Battery check to determine if battery is functional to full scale. Batteries are replaced if found weak.

URS
STANDARD OPERATING PROCEDURE 110
pH METER

Page 2 of 4

- **Electrode check** in accordance with the user's manual from the manufacturer. If the electrode check indicates potential problems with the electrode, a different electrode and/or pH meter must be obtained or the electrode must be repaired before going into the field.
- **Meter calibration** in accordance with the user's manual from the manufacturer. Calibration schedule should include daily calibration, and intermittently, when required, during continuous use of the meter. Instrument calibration consists of calibration of the pH meter with pH 7 and pH 10 buffers, and a pH 4 buffer as a check, or with pH 7 and pH 4 buffers, and a pH 10 buffer as a check, depending on the average expected pH values of the samples.

The calibration for pH is temperature correlated. Please note the **actual** pH of your buffers at the temperature used for calibration. (A chart for this is usually provided on the buffer container.) If the pH meter does not have automatic temperature compensation, you may need to calibrate the 7 buffer to 6.95 or 7.03, or some point in between, depending on the temperature of your buffers. Some pH meters compensate for temperature, but require the user to set a temperature knob on the meter to the measured value. Refer to the user's manual for the pH meter to determine what temperature compensation features the meter has, if any, and follow the meter-specific instructions.

Calibration should be accomplished through the following steps:

1. Place the electrode in the pH 7 buffer solution and adjust the meter to read 7.0, or the appropriate value given on the buffer container.
 2. Rinse the electrode with de-ionized water.
 3. Place the electrode in the pH 4 or pH 10 buffer and adjust the meter slope until the meter reads the appropriate value.
 4. Rinse the electrode with de-ionized water.
 5. Place the electrode in the pH 4 or pH 10 buffer, whichever was not used in Step 3, and read the pH of the check buffer. If the value is not within 0.1 pH unit of the expected value, repeat the calibration procedure. If the meter cannot be successfully calibrated on several successive attempts, another meter should be used or the meter should be repaired prior to use.
 6. Record calibration information in the field logbook or on a calibration data sheet. Note any problems encountered during calibration.
- **Scheduled maintenance** will include daily checks by URS trained personnel according to procedures provided by the equipment's manufacturer.
 - **Repairs** will be performed by an authorized service representative.

URS
STANDARD OPERATING PROCEDURE 110
pH METER

Page 3 of 4

5.0 OPERATING PROCEDURE

1. Turn on power and allow meter to stabilize for about three to five minutes. Caution: Do not leave or use meter in direct sunlight or cold wind.
2. Measure pH of unknown solution in accordance with user's manual. If the pH meter does not have automatic temperature compensation, the temperature of the sample must also be measured and recorded. On some pH meters, it may be necessary to adjust a temperature dial to the temperature of the sample. The meter will then compensate for the sample temperature and report the pH under standard conditions.
3. Record the pH reading and sample temperature in the field logbook or on a data sheet and note whether the pH given is compensated to standard conditions (25°C) or at the temperature of the sample.
4. Obtain one duplicate field measurement for every 20 measurements performed. Initial measurement and duplicate measurement should be within 20 percent.
5. Quality assurance objectives of pH measurement based on EPA Method 150.1, Electronic Measurement of pH (USEPA, 1983)^a should consist of: Precision (standard deviation): ± 0.1 pH unit accuracy determined, based on instrument manufacturer's specific value.

^a USEPA 1983. Methods for chemical analysis of water and wastes. Environmental Monitoring and Support Laboratory, Office of Research and Development. EPA-600/4-79-020. U.S. Environmental Protection Agency, Cincinnati, Ohio

URS
STANDARD OPERATING PROCEDURE 110
pH METER

Page 4 of 4

INSTRUMENT CALIBRATION LOG

INSTRUMENT:			
MANUFACTURER:			
MODEL NUMBER:			
SERIAL NUMBER:			
URS ASSET NUMBER:			
DATE ACQUIRED OR SERVICED:			
ORIGINAL OR PREVIOUS CALIBRATION DATE:			
CALIBRATED BY:			
NOTES ON ORIGINAL OR PREVIOUS CALIBRATION:			
CALIBRATION SCHEDULE: (circle one)	DAILY	MONTHLY	YEARLY
MAINTENANCE SCHEDULE: (circle one)	DAILY	MONTHLY	YEARLY
CURRENT CALIBRATION RECORD:			
DATE:		TIME:	
CALIBRATION STANDARD(S) USED:			
CONCENTRATION(S):			
PROCEDURE (describe briefly):			
DEFICIENCIES: (if any):			
CALIBRATION PLOTS OR GRAPHS (attach, if any)			
SIGNATURES:			
Name:		Date:	

URS
STANDARD OPERATING PROCEDURE 120
SPECIFIC CONDUCTANCE METER

Page 1 of 3

1.0 SCOPE

This procedure describes the operation, calibration, and maintenance of conductivity meters for use in the field sampling activities. Manufacturer's specifications and recommendations for the specific conductivity meter used should also be followed. Project-specific quality assurance objectives may indicate calibration schedules and/or criteria which override those provided in the SOP.

2.0 OBJECTIVES

The activities covered by this procedure:

- Insure quality control in field conductivity measurement.
- Insure uniformity and continuity in operation, calibration, and maintenance of both the equipment and measuring techniques by different qualified field analysts or technicians.
- Provide semi-quantitative data for use in determining relative variations in conductivity between two or more water (surface water and/or groundwater) samples.
- Indirectly serve as a means to evaluate the water quality at the time of sampling. It is imperative that temperature compensation is made because conductivity measurements are very sensitive to the temperature of the solution being measured.

3.0 EQUIPMENT NEEDED

- Conductivity meter^a.
- Reference solutions.
- Thermometer.
- Plastic cup or beaker (at least 20 mL volume).
- Distilled water.
- Polyethylene wash bottle.
- Trash receptacle.
- User's manual for conductivity meter.

^a Portable conductivity meters available with Dames & Moore for use in field include:

- Myron L pDS Meter - Model EP11/pH;
- CSI pH/Temperature/Conductivity Tester - Catalog No. 301353;
- Omega pH and Conductivity Pens; and
- Extech Conductivity and Temperature Meter.

4.0 PRELIMINARY TO OPERATION

1. Examine the conductivity meter for cleanliness, defects, and any possible need of repair. Check the battery and conductivity probe or cell for proper function.

URS
STANDARD OPERATING PROCEDURE 120
SPECIFIC CONDUCTANCE METER

Page 2 of 3

2. Calibrate the conductivity meter in accordance with the user's manual provided by the manufacturer. Calibration of the specific conductivity meter should be made with a standard of approximately the same conductivity as those expected at the site, and should be measured at (or converted to) 25°C. Some conductivity meters automatically compensate for temperature, some compensate after the user adjusts a temperature knob on the meter to the measured temperature, and others have no temperature compensation feature. Refer to the user's manual to determine what temperature compensation features the conductivity meter has and follow the directions. The calibration of the field instruments must be checked every four hours and at the end of the day. If the calibration check is not within $\pm 5\%$ of the expected value, the meter must be recalibrated.

Record calibration information in the field logbook or on an instrument calibration data sheet.

3. Scheduled maintenance will include daily checks by URS trained personnel according to procedures provided by the equipment's manufacturer.
4. Repairs will be performed by authorized service representative.

5.0 OPERATING PROCEDURE

1. Measure conductivity and temperature of sample following manufacturer's instructions.
2. Remove probe from sample solution and rinse it thoroughly in de-ionized waste before proceeding to measure next samples or putting away the equipment.
3. Record data in field logbook or on data sheets.
4. Obtain one duplicate field measurement for every 20 measurements performed. Initial measurement and duplicate measurement should be within 20 percent.

URS
STANDARD OPERATING PROCEDURE 120
SPECIFIC CONDUCTANCE METER

Page 3 of 3

INSTRUMENT CALIBRATION LOG

INSTRUMENT:	
MANUFACTURER:	
MODEL NUMBER:	
SERIAL NUMBER:	
URS ASSET NUMBER:	
DATE ACQUIRED OR SERVICED:	
ORIGINAL OR PREVIOUS CALIBRATION DATE:	
CALIBRATED BY:	
NOTES ON ORIGINAL OR PREVIOUS CALIBRATION:	
CALIBRATION SCHEDULE: (circle one) DAILY MONTHLY YEARLY	
MAINTENANCE SCHEDULE: (circle one) DAILY MONTHLY YEARLY	
CURRENT CALIBRATION RECORD:	
DATE:	TIME:
CALIBRATION STANDARD(S) USED:	
CONCENTRATION(S):	
PROCEDURE (describe briefly):	
DEFICIENCIES: (if any):	
CALIBRATION PLOTS OR GRAPHS (attach, if any)	
SIGNATURES:	

URS
STANDARD OPERATING PROCEDURE 130
THERMOMETER

Page 1 of 2

1.0 SCOPE

This operating procedure describes the operation, calibration, and maintenance of a thermometer and its accessories for use in the field. Manufacturer's specifications and recommendations for the specific thermometer used should also be followed.

2.0 OBJECTIVES

The activities covered by this procedure:

- Insure quality control in field temperature measurement.
- Insure uniformity and continuity in operation, calibration, and maintenance of both the equipment and measuring techniques by different qualified field analysts or technicians.
- Provide an accurate means of compensating pH and conductivity measurements to standard conditions.

3.0 EQUIPMENT NEEDED

- Thermometer^a with mercury bulb, or probe in modern meters.
- Field log.
- Sample container.

^a Thermometers available with URS for use in the field, such as:

- Temperature Indicator MyCal Model SA-754-B;
- CSI pH/Temperature/Conductivity Tester - Catalog No. 301353; and
- Extech Conductivity and Temperature Meter.

4.0 PRELIMINARY TO OPERATION

1. Check the thermometer for accuracy before each sampling event against an NBS calibrated thermometer.
2. Record the calibration check in the field logbook or on data sheets.
3. For electronic temperature meters, check the battery.

URS
STANDARD OPERATING PROCEDURE 130
THERMOMETER

Page 2 of 2

5.0 OPERATING PROCEDURE

5.1 Temperature Meters

1. Turn the meter on.
2. Plug the jacks on the probe into the thermometer.
3. Lower the probe into the sample and record measured temperature in field logbook or on the sampling data sheet.
4. Decontaminate probe when finished.
5. Obtain one duplicate field measurement for every 20 measurements performed. Initial measurement and duplicate measurement should be within 20 percent.

5.2 Bulb Thermometers

1. Lower bulb into sample and allow to equilibrate.
2. Record measured temperature in field logbook or on sampling data sheet.
3. Decontaminate thermometer when finished.
4. Obtain one duplicate field measurement for every 20 measurements performed. Initial measurement and duplicate measurement should be within 20 percent.

URS
STANDARD OPERATING PROCEDURE 140
SOIL SAMPLE COLLECTION FROM BOREHOLES

Page 1 of 2

1.0 SCOPE

This procedure describes the collection of soil samples from soil borings advanced with a direct push (Geoprobe) drill rig.

2.0 OBJECTIVES

- Insure that the representative soil and groundwater samples will be collected to properly characterize site conditions.
- Insure quality control and consistency in taking samples.
- Serve as a means to allow traceability of error(s) in sampling and data recording.

3.0 PROCEDURE

3.1 Borehole locations

All boreholes will be horizontally located by measurements to fixed structures or reference points on the site. Locations will be marked with a stake, flag, or paint, and utilities will be cleared through Digger's Hotline prior to drilling.

3.2 Method of Drilling

Boreholes will be advanced with a direct push (Geoprobe) drill rig.

3.3 Formation Sampling

Samples will be collected continuously with a Geoprobe macro sampler. The macro sampler is a core sampler that is advanced by a solid rod with the Geoprobe. For each sample, a clear plastic liner will be placed in the macro sampler. The soil sample within the plastic liner will be extracted from the macro sampler, and examined by the URS field manager. Soil units will be visually classified in accordance with the Unified Soil Classification System (USC), and recorded on a field boring log. In areas where volatile compounds are suspected or encountered, soil samples will be screened as needed with a photoionization detector, and readings will be recorded on the boring log.

3.4 Soil Sample Collection

Representative soil sample will be collected for laboratory analysis based on visual observation and field screening results. In accordance with SOP 160, each soil sample will be collected by placing soil in laboratory provided containers. Samples selected for VOC analysis, will be collected by placing 25 to 35 grams of in a 60 mL glass jar. The sample will then be preserved by adding 25 mL of methanol. All samples selected for VOC analysis will be preserved with methanol within 2 hours of sample collection. Samples selected for percent solids, cyanide, and metals analysis will be placed in a single plastic bottle provided by the laboratory, and filled (zero head space).

URS
STANDARD OPERATING PROCEDURE 140
SOIL SAMPLE COLLECTION FROM BOREHOLES

Page 2 of 2

3.5 Decontamination

All down hole drilling tools will be decontaminated in accordance with SOP 190 between boring locations.

3.6 Borehole Abandonment

Following soil and groundwater sample collection, all borings will be abandoned in accordance with NR 141 requirements. Each well will be backfilled with granular bentonite. (The temporary well casing and screen will be removed from boreholes from which groundwater samples were obtained.) The volume of material used to backfill each borehole will be recorded on well abandonment forms (WDNR Form 3300-5P). Concrete or asphalt will be patched as needed.

URS
STANDARD OPERATING PROCEDURE 150
GROUNDWATER SAMPLE COLLECTION FROM MONITORING WELLS

Page 1 of 4

1.0 SCOPE

This operating procedure describes steps involved in well purging and preparation for taking groundwater samples using a bailer and its accessory equipment. Manufacturer's specifications and recommendations for the bailer should be followed.

2.0 OBJECTIVES

The activities covered by this procedure:

- Insure that the groundwater samples taken will be representative of actual groundwater quality.
- Insure quality control and consistency in taking samples.
- Serve as a means to allow traceability of error(s) in sampling and data recording.

3.0 EQUIPMENT NEEDED

- Bailer constructed of Teflon®, stainless steel, or PVC pipe.
- A reel to raise and lower bailer, if using wire line.
- A 3 to 5 gallon pail to measure purge water volume.
- A line to lower bailer, made of Teflon, polypropylene, nylon or stainless steel wire.
- A tarp or plastic sheet to cover ground and to lay bailer, line, reel, and water level tape.
- pH meter, conductivity meter, and thermometer.
- A field log and calculator.
- A water level measuring tape.
- Spare batteries for field instruments.

4.0 PRELIMINARY TO OPERATION

1. Review project work plan for site-specific sampling requirements and procedures.
2. The bailer, reel, line, water level measuring tape, thermometer, pH and conductivity meters should be cleaned, checked for defects, and any possible need for repair.
3. Batteries should be checked in the pH meter (SOP 110), conductivity meter (SOP 120), and calculator.
4. A decontaminated tarp or plastic sheet should be placed on the ground for the bailer, reel, line, and water level measuring tape to be upon.

URS
STANDARD OPERATING PROCEDURE 150
GROUNDWATER SAMPLE COLLECTION FROM MONITORING WELLS

Page 2 of 4

5.0 OPERATING PROCEDURE

Procedures for collecting groundwater samples from monitoring wells are as follows:

1. Place tarp around well by cutting a slit in the tarp and lowering it around the protective casing.
2. Record the well number, time, and date and all pertinent information and data on groundwater sampling record, or other data sheet or field logbook.
3. Identify measuring point, marked on well casing. Measure the depth to groundwater in the well to the nearest 0.01 foot with water level tape. Measure depth to the bottom of the well to the nearest 0.01 foot with a weighted tape. Enter these data on the groundwater sampling record. The measuring tape must be decontaminated following the procedures outlined in SOP 100.

$$Volume (gallons) = \pi \times H \times \left(\frac{D}{24}\right)^2 \times \frac{7.48 \text{ gal}}{ft^3}$$

4. Calculate the volume of water in the well using the equation:

Where: H = Depth of Well minus Depth to Water (feet); and
D = Inside diameter of well (inches).
5. Tie line securely to bailer.
6. Lower the bailer in the well to just below the water level and retrieve when filled.
7. Empty bailer into the measuring pail. Purge water should be disposed of in accordance with the project work plan.
8. Continue purging the well until at least four times the volume calculated in Step No. 4 has been removed. For low permeability formations, continue purging until the well is dry. If time permits, allow the well to recover completely and bail dry a second time. Record the actual volume of water purged and note whether the well was bailed dry on the sampling record or in the field logbook.
9. Allow water level to recover sufficiently so that an adequate volume of water for the intended analyses is present. It is not necessary for the water level to return to its original level.
10. Remove one bail of water from the well and record its temperature, pH, and conductivity. Record the measurements and the time.

STANDARD OPERATING PROCEDURE 150

GROUNDWATER SAMPLE COLLECTION FROM MONITORING WELLS

11. Begin removing sample bails with the bailer and line. Use the first bail for VOC analysis and pour into bottle using care not to stir and allowing air bubbles to escape. Use last bail for metals analysis. Filter groundwater samples per SOP 170 for dissolved metals analyses. Required sample containers and preservative requirements are discussed in the project work plan. Between removing bails, do not lay bailer or line on the ground unless it is covered with a new or decontaminated tarp or plastic sheet.
12. Affix labels to each sample bottle recording sample number, well number, date, and time.
13. Record sample information on sampling record or in field log, along with a description of the physical appearance of the sample, including color, odor, and turbidity.
14. Place samples immediately in a shipping container maintained at 4°C.
15. Decontaminate bailer and reel if used, as described in SOP 190, and replace bailer line.

STANDARD OPERATING PROCEDURE 150

GROUNDWATER SAMPLE COLLECTION FROM MONITORING WELLS

Page 4 of 4

GROUNDWATER SAMPLING RECORD

SITE NAME: _____
 PROJECT NO.: _____
 DATE: _____

WELL NO.: _____
 SAMPLERS: _____
 TIME: Start: _____ End: _____

WATER LEVEL OBSERVATIONS

WELL DIAMETER: _____
 TOC ELEVATION: _____

DEPTH OF WELL: _____
 DEPTH OF WATER: _____

GROUNDWATER ELEV.: _____

WATER COLUMN (H): _____

PURGING

WELL DIA.	VOLUME
2"	0.163 gal/ft
3"	0.364 gal/ft
4"	0.653 gal/ft
5"	1.01 gal/ft
6"	1.46 gal/ft
7"	1.98 gal/ft
8"	2.59 gal/ft

PURGE METHOD

BAILER

PUMP

INFORMATION

PURGE VOLUME

TO PURGE: _____ gallons
 ACTUAL PURGED: _____ gallons

PURGED DRY? _____
 PUMP FLOW RATE: _____
 DEPTH TO WATER AFTER
 PURGING _____
 PROBLEMS: _____

FIELD TESTING		FIELD PARAMETERS		WELL CONDITION	
PH		COLOR		LOCK	
CONDUCTIVITY		ODOR		PROTOP	
TEMPERATURE		TURBIDITY		CAP	
ORP					
DO					

SAMPLING INFORMATION

VOLUME

PRESERVATIVE

FILTERED?

_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____

COMMENTS

URS
STANDARD OPERATING PROCEDURE 160
VOC, SVOCs, AND INORGANICS SAMPLE COLLECTION

Page 1 of 2

1.0 SCOPE

This procedure describes the methods that will be used to collect soil and groundwater samples for VOCs, SVOCs, and inorganic compounds.

2.0 OBJECTIVES

The activities covered by this procedure:

- Insure quality control in field sampling for volatile organic compounds (VOCs), semi-annual volatile organic compounds (SVOCs), and inorganic compounds (cyanide).
- Insure uniformity and continuity in sampling techniques and use of the equipment by different qualified field samplers or technicians.
- Serve as a means to allow traceability of error(s) in sampling.

3.0 EQUIPMENT NEEDED

- Laboratory supplied sample containers.
- Labels.
- Distilled or de-ionized water.
- Waterproof marking pen or pencil.

4.0 PROCEDURE

Water and surface water sample collection for VOC, SVOCs, and inorganic compounds consists of the following steps:

1. Fill VOC vials first. Remove cap of vial just prior to sampling.
2. Hold cap in same hand as the bottle.
3. For VOC water samples, tilt vial slightly into water and fill slowly to minimize the turbulence and aeration. Bailer bottom emptying device is recommended.
4. For VOC water samples, fill vial to overflow insuring that a positive meniscus is formed. Place cap on top of septum and quickly screw it on tightly.
5. If bubbles are present in VOC water samples, discard the sample and begin over with a new set of vials. If no bubbles are present, label and mark it with project number, description, sample number, sampler's initials, date and time of sampling, etc., with a waterproof marker.
6. For SVOCs and inorganic compound samples, remove lids of plastic laboratory supplied bottles just prior to sample collection.

STANDARD OPERATING PROCEDURE 160
VOC, SVOCs, AND INORGANICS SAMPLE COLLECTION

7. Tilt bottle into water and fill slowly to minimize the turbulence and aeration. Bailer bottom emptying device is recommended. Follow procedures in SOP 170 for field filtering. Place lid on bottle. Label and mark it with project number, description, sample number, sampler's initials, date and time of sampling, etc., with a waterproof marker.
8. Wash outside of vials and bottles with distilled or organic free water and wipe clean with a paper towel.
9. Store in ice-packed sample container and ship with a chain-of-custody record.

Soil sample collection for VOC, SVOCs, and inorganic compounds consists of the following steps:

1. Fill VOC jars first. Remove cap of vial just prior to sampling. Place jar on field scale to obtain tar weight.
2. Place 25 to 35 grams of soil in VOC jar using spatula as needed.
3. Add 25 mL of methanol to preserve sample. Place lid on bottle. Label and mark it with project number, description, sample number, sampler's initials, date and time of sampling, etc., with a waterproof marker.
4. For SVOC and inorganic compound samples, remove lids of plastic or glass laboratory supplied bottles just prior to sample collection.
5. Fill bottle with soil (zero head space). Place lid on bottle. Label and mark it with project number, description, sample number, sampler's initials, date and time of sampling, etc., with a waterproof marker.
6. Wash outside of vials and bottles with distilled or organic free water and wipe clean with a paper towel.
7. Store in ice-packed sample container and ship with a chain-of-custody record.

URS
STANDARD OPERATING PROCEDURE 170
FILTERING GROUNDWATER FOR METALS

Page 1 of 1

1.0 SCOPE

This procedure describes the methods for filtering suspended particulates from groundwater samples for metals analyses.

2.0 OBJECTIVES

The activities covered by this procedure:

- Insure quality control in filtering of groundwater samples for analysis of dissolved metals.
- Insure uniformity and continuity in sampling techniques and use of the equipment by different qualified field samplers or technicians.
- Serve as a means to allow traceability of error(s) in sampling.

3.0 EQUIPMENT NEEDED

- Peristaltic pump and tubing.
- Disposable 0.45 micron in-line filter.
- Labels and sample bottles.
- Distilled or de-ionized water.
- Waterproof marking pen or pencil.

4.0 PROCEDURE

Field filtering groundwater for metals analysis will consists of the following steps:

1. Inspect filtering equipment and filters for cleanliness and defects, and need for repair.
2. Obtain groundwater sample and fill transfer bottle or container.
3. Using peristaltic pump, pump water from transfer bottle through the in-line 0.045 micron filter, and discharge to laboratory supplied container.
4. Filter groundwater samples within 15 minutes of sample collection.

URS
STANDARD OPERATING PROCEDURE 180
EQUIPMENT BLANK SAMPLING

Page 1 of 1

1.0 SCOPE

This procedure describes the methods for collecting an equipment blank sample.

2.0 OBJECTIVES

The activities covered by this procedure:

- Insure quality control in field sampling operations.
- Serve as a means to detect contamination that may result from sampling procedures.
- Provide documentation of equipment decontamination procedures.

3.0 EQUIPMENT NEEDED

- Sampling equipment.
- Labels and sample bottles.
- Distilled or de-ionized water.
- Waterproof marking pen or pencil.

4.0 PROCEDURE

Field blank collection will consists of the following steps:

1. Obtain appropriate sample containers in accordance with the Sampling and Analysis Plan (SAP). The SAP will designate the sampling intervals and parameters for equipment blank sampling.
2. Clean equipment in accordance with the project decontamination procedures (SOP 190).
3. Rinse the equipment with organic-free distilled water, and collect the rinse water. For metals analysis, the water must pass through the filtering mechanism.
4. Fill each sample container with rinse water used to clean the sampling equipment. Sample containers for VOC analysis should be filled first, and sample bottles for metals analysis should be filled last.

URS
STANDARD OPERATING PROCEDURE 190
DECONTAMINATION PROCEDURES

Page 1 of 2

1.0 SCOPE

This operating procedure describes procedures used to decontaminate equipment used during environmental sampling of hazardous waste sites. Project-specific quality assurance objectives, provided in the project work plan and/or quality assurance plan, may override some of the procedure specified in the SOP.

2.0 OBJECTIVES

The activities covered by this procedure:

- Prevent cross-contamination between samples.
- Insure quality control in decontamination of field equipment used in sampling and handling environmental samples.
- Help to maintain a clean working environment for the safety of field personnel.
- Serve as a means to allow traceability of errors in procedures.

3.0 EQUIPMENT NEEDED

- Tap water and distilled water or de-ionized water.
- Personal safety gear (specified in project Health and Safety Plan).
- Five-gallon stainless steel pail and plastic buckets.
- Detergent (Alconox).
- Nylon scrub brush and long handled bottle brush.
- Aluminum foil and paper towels.
- Trash receptacle.

4.0 PROCEDURE

1. Select an area of the site removed from sampling locations. If it can be determined, the area should be down gradient from wells being sampled.
2. Fill a 5-gallon pressurized sprayer or smaller squirt bottle with distilled water.
3. Wash all grit, grime, mud, particulates, etc., from the equipment being decontaminated with tap water and collect in a plastic bucket.
4. Put one gallon of distilled water into a 5-gallon stainless steel pail and add 1-cup of detergent.
5. Wash equipment in the pail using a nylon scrub brush or long handled bottle brush.
6. Rinse all residual detergent from the equipment with the sprayer and collect rinsate.

URS
STANDARD OPERATING PROCEDURE 190
DECONTAMINATION PROCEDURES

Page 2 of 2

7. Repeat steps 5 and 6 as necessary.
8. Rinse the equipment thoroughly with organic free distilled water and collect the fluid in a plastic bucket.
9. Dry and then wrap the equipment securely in aluminum foil or polyethylene sheeting.
10. Dispose of soiled materials and fluids in designated disposal containers in accordance with the project-specific plan.

APPENDIX B

NORTHERN LAKE SERVICE, INC. QUALITY ASSURANCE/QUALITY CONTROL MANUAL AND PROJECT SPECIFIC ATTACHMENTS

APPENDIX B

TABLE OF CONTENTS

- *Northern Lake Service, Inc. QA/QC Manual*
- *ATTACHMENT 1 - Example of Level 4 QC Data Package (VOC's)*
- *ATTACHMENT 2 - Example of Level 4 QC Data Package (SVOC's)*
- *ATTACHMENT 3 - Example of Level 4 QC Data Package (Cyanide)*
- *ATTACHMENT 4 - Example of Level 4 QC Data Package (Hex-Chromium)*
- *ATTACHMENT 5 - Example of Level 4 QC Data Package (Trace ICP Metals)*
- *ATTACHMENT 6 - Example of Level 4 QC Data Package (ICP Metals)*
- *ATTACHMENT 7 - Example of Level 4 QC Data Package (AA Furnace Metals)*
- *ATTACHMENT 8 - Example of Level 4 QC Data Package (AA Cold Vapor Mercury)*
- *ATTACHMENT 9 - Example of Level 4 QC Data Package (AF Cold Vapor Mercury)*
- *ATTACHMENT 10 - Analytical Methods – Standard Operating Procedures*
- *ATTACHMENT 11 - Examples of NLS Laboratory QA Sample Handling Forms and Labels*
- *ATTACHMENT 12 - NLS Project Method Detection Limits – Inorganic and Inorganic*

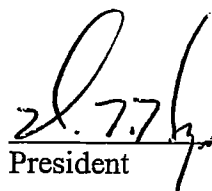
**NORTHERN LAKE SERVICE, INC.
QUALITY ASSURANCE/QUALITY CONTROL
MANUAL**

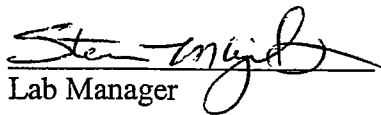
This manual documents the methods and procedures used by Northern Lake Service (NLS) to comply with NR149 Wisconsin Administrative Code. Methods are taken from authoritative sources with some modifications recommended by instrument manufacturers to increase analytical performance and ease of instrument operation.

This QA/QC manual is updated annually.

Approved By:

Northern Lake Service, Inc
400 North Lake Avenue
Crandon, Wisconsin 54520
715/ 478-2777


President


Lab Manager

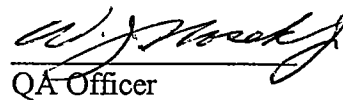

QA Officer

TABLE OF CONTENTS

	<u>Page</u>
General Information	3
Key Technical Personnel	4
Data Confidentiality	8
Lab and Field Security	8
References of Methodology	10
Reporting Data	11
Laboratory Chemicals and Gases	11
In-House Bottle Check Procedure	11
Sample Preservation and Holding Times	12
Analytical Records	13
Methods and Detection Limits	14
General Quality Control	14
Laboratory Quality Control Limits	15
Field Sampling Quality Control	18
Analytical Equipment	18
Instrument Calibration	19
Preventative Maintenance	22
Laboratory Information Management System	22
Analysis of Quality Control Samples	23
Safe Drinking Water Act	24
Table 1: Summary of Special Sampling/Handling Requirements	25
Table 2: Detection Limits and Corresponding Methods	27
Table 3: Field Sample Characteristics	43
Table 4: Certification Parameters	45
Table 5: Safe Drinking Water Methods	47
Figure 1: Example of Quality Control Charts	49
Figure 2: Northern Lake Service, Inc. - Organizational Chart	50

GENERAL INFORMATION

Northern Lake Service began operations in 1974 to provide analytical and consulting support for Wisconsin's Inland Lake Renewal Program. Under that program NLS conducted comprehensive lake studies requiring collection, analysis, and interpretation of groundwater and surface water samples along with hydrological and biological investigations to determine water quality and lake management alternatives for about 30 Wisconsin lakes. It was under this program that our reputation for analytical expertise and accurate results became recognized and grew.

NLS has continued to provide new environmental services in response to client needs. Procedures and methods are chosen or developed to provide the most accurate and precise information in the most efficient and timely manner. Consequently, our ever-expanding list of satisfied clients includes various industries, landfills, municipal waste treatment plants, public water utilities, government agencies, and private parties.

Our modern laboratory is equipped with state-of-the-art instrumentation for analyzing drinking water, groundwater, process water, wastewater, soil, sediments, and tissue for inorganic, organic, and physical constituents. We are certified as an environmental laboratory in the state of Wisconsin for Drinking Water and Wastewater analyses. In addition, NLS is one of the few labs in Wisconsin to become certified under the Safe Drinking Water Act (SDWA), and by our request, one of the first to undergo the comprehensive lab audit required under this certification program.

While much of our effort is committed to providing analytical lab services, we also offer a variety of field services. Our groundwater sampling service, which utilizes an efficient in-line field filtering procedure to insure the collection of representative samples, has set the standard for producing reliable groundwater data and has become our primary field service.

The NLS staff take particular pride in producing objective, reliable, accurate, and precise environmental data. Praise and satisfaction, both from our clients and from the regulatory agencies, provide the chief driving force at Northern Lake Service. We strive to grow both in technology and client-base without losing the level of personal service and efficiency associated with being small.

NLS has developed a program of QA and QC procedures that provide our clients with defensible, cost effective and timely results. Management creates a culture of integrity, continuous improvement in knowledge and equipment, and reliable client service. A key part of this culture is providing employees with educational resources for training, keeping current on technological and regulatory changes. As a result, employees are empowered to make decisions that not only meet, but exceed our client's expectations.

RESUMES OF KEY PERSONNEL

RONALD K. KRUEGER, Founder and Chairman of the Board

Ron Krueger founded Northern Lake Service in 1974 and while less involved in day to day operations he provides valuable oversight of numerous management issues. He also remains active in various NLS field activities, developing and refining sampling procedures and programs to meet clients' needs.

Ron's environmental experience spans over 36 years and includes: conducting biological and chemical surveys and coordination of waste disposal programs in the paper industry; drainage basin surveys and administration of aquatic nuisance control programs in Wisconsin Department of Natural Resource's Lake Michigan District; lake management consultation and field investigation for over 30 lake districts while at NLS. He served as president and chairman of the Board of NLS for 26 years.

Ron holds a B.S. in biology and general science from the University of Wisconsin-Stevens Point. He is a member of the American Water Well Association and the Wisconsin Ground Water Association.

RONALD T. KRUEGER (R.T.), President and Chief Executive Officer

R.T. provides management of day to day company operations, working with supervisors, QC, Marketing, LIMS and Client Services to assure client needs are met.

R.T. has over 21 years of experience in environmental analysis and field sample collection. He has developed a variety of technical skills, working as a field technician, inorganic analyst, groundwater monitoring crew chief, limnologist and Laboratory Manager position at NLS prior to becoming president.

He has a B.S. in Biology and Earth Sciences from the University of Wisconsin Stevens Point. R.T. is a member of the Wisconsin Groundwater Association.

STEVEN L. MLEJNEK, Laboratory Manager

Steve Mlejnek provides direct coordination of laboratory operations, both organic and inorganic at Northern Lake Service. With the department supervisors, Steve oversees routine analysis and the training of laboratory personnel. He is also involved as the technical liaison with clients and regulatory agencies.

Steve has experience in the analysis of volatile organic analyses. The analyses are performed by gas chromatograph/mass spectrometry on a Varian Saturn III GC/MS system. Steve also provides analytical and troubleshooting help for other volatile organic methods including EPA methods 8260, 8021, and petroleum methods. He has over 11 years of experience in environmental analysis.

Steve graduated from the University of Wisconsin - Stevens Point with a B.S. in Natural Science. He attended Varian Instrument's "Environmental Applications of GC/MS" course and Tekmar Instrument's "Purge and Trap Users School".

MALCOLM C. GROSS, Sales/Marketing Director

Mal Gross has over 28 years of experience in sales and marketing of technical products and services, about twelve of those in the environmental laboratory and consulting field. He currently provides overall direction of sales/marketing for NLS, including long term strategic planning input and short / long-term sales promotion.

He also provides liaison with clients, subcontractors and industry trade groups. Mal is primarily responsible for bids, quotations and contracts for analytical services, and provides project management and review for selected projects.

Mal graduated with honors from the University of Wisconsin –Green Bay, with a B.S. in General Management. He has about 30 college credits in science and math, and has completed some graduate work in Business Administration. He has also attended many seminars and programs in environmental subjects.

Mal is a member of the Federation of Environmental Technologists, Water Environment Federation, Wisconsin Laboratory Association, Wisconsin Ground Water Association, American Water Well Association, Central States Water Environment Association, American Water Resources Association and the Wisconsin Wastewater Operators Association.

W. JOSEPH NOSEK, Jr., Quality Assurance Officer

Joe Nosek oversees the NLS quality assurance program and the Continuous Quality Improvement Program, which he instituted at NLS. Joe also monitors data quality and adherence to Standard Operating Procedures (SOP's). He interacts with regulatory agencies and is generally responsible for maintaining current laboratory certification by those agencies.

Joe graduated from the University of Minnesota at Duluth with a B.S. in Earth Sciences. He has completed courses in quality assurance from the National Bureau of Standards and the Association of Official Analytical Chemists, and Good Laboratory Practices from the Society of Quality Assurance. He is a member of the American Society of Testing and Materials and the American Society for Quality from which he has earned the Certified Quality Auditor Certificate. Joe has over 16 years of experience in quality assurance with environmental laboratories.

TRACY HUBER, Client Service Representative

Tracy Huber has over 10 years of experience at Northern Lake Service interacting directly with clients. Tracy is actively involved in all laboratory – client communications, subcontractor management, project initiation and progress, and assists in quotations. Prior to joining the Client Service Department she supervised the Sample Receiving and Shipping departments. Tracy has an Administrative Assistant Associates Degree from Nicolet College. She has also attended seminars covering a variety of Office Management and Client Service Representative skills.

ANDREW J. OSTROWSKI, Environmental Scientist/Client Services

Andy Ostrowski performs many client service activities, such as quotations, data package review, project management and subcontractor liaison. He also has over 11 years of field sampling experience and provides general oversight of those services at NLS.

Andy holds a B.S. in Water-Resources, Chemistry and Soil Science from the University of Wisconsin-Stevens Point. He has also attended WGWA seminars and has completed OSHA's required 40-hour HazWaste Site Training. Andy is a member of the Wisconsin Ground Water Association.

DAWN M. DREHER, Office Coordinator / Purchasing Agent

Dawn coordinates the day-to-day operations of the Northern Lake Service office, including scheduling, communications, invoicing, accounts receivable, accounts payable, and filing. Dawn also conducts and monitors the corporate purchasing functions for the evaluation, purchase, and receipt of all laboratory and field supplies. She has 19 years of office experience and administration, with 10 of those years served at NLS. Dawn has completed several office operations and administration seminars and is a member of the American Purchasing Society.

CHRIS GESKE, LIMS Manager

Chris Geske manages the programming, operation and maintenance of the NLS Laboratory Information Management System. He also oversees the operation and maintenance of instrument data systems and networks.

Chris works closely with the Laboratory Manager and the Quality Assurance Officer, as well as with laboratory staff. He attended the Milwaukee School of Engineering and has an Associate degree in electronics from North Central Wisconsin Technical College.

THOMAS R. PRIEBE, Inorganic Supervisor

Tom Priebe provides supervision of the Inorganics department including metals and wet chemistry parameters. His background also allows Tom to specialize in troubleshooting analytical interferences in complex waste matrices.

He has experience with a large waste disposal company, as well as with the WDNR where he was involved with field sampling, analysis, and maintenance.

Tom holds a B.S. degree in Water Chemistry from the University of Wisconsin - Stevens Point, and has completed the 40 hours training in Health, Safety & Management of Hazardous Materials per 29 CFR 1910.120. He has over 11 years of experience.

JERRY BOCK, Semi-Volatiles Supervisor

Jerry Bock provides supervision of the organics department including gas chromatography for semi-volatile organics and pesticides/PCBs. He has a strong background in organic chemistry and over 21 years of analytical chemistry experience.

Jerry has a B.S. in Medical Technology from the University of Wisconsin-Eau Claire. He has also attended Hewlett-Packard courses in gas chromatography techniques.

RUSS A. WOLFF, Team Leader/Chemist - Volatiles Department

Russ Wolff conducts analyses for volatile organic compounds by gas chromatography and gas chromatography/mass spectrometry. He has over 8 years of analytical experience working with various purge and trap systems in areas of Gasoline Range Organics/Petroleum Volatile Organic Compounds, and Volatile Organic Compounds. Russ holds a B.S. degree in Chemistry from Northland College - Ashland.

CRAIG S. CASELTON, Chemist - Organic Department

Craig Caselton conducts analyses for Pesticides and PCBs by gas chromatography. He has over 6 years of analytical experience working with various purge and trap systems for the GRO/PVOC compounds as well as Pesticides and PCBs. Craig holds a B.S. degree in Water Chemistry from the University of Wisconsin - Stevens Point.

DOUGLAS M. JENNINGS, Chemist-Inorganics Department

Doug Jennings has 19 years of experience in the analysis of environmental samples for metals. He currently analyzes various matrices for metals, using AA-flame, AA-graphite furnace, AA/AF-cold vapor and ICP techniques. Doug graduated from Central Michigan University with a B.S. in Chemistry/Biology. His experience includes analysis of samples from USDOD and USDOE programs under CLP and GLP requirements.

DATA CONFIDENTIALITY

The results of all analyses are confidential. Data are only released to the client, or to an agent of the client if NLS has received prior written authorization from the client. Unless the data has been subpoenaed by a court action, state and federal officials may only receive copies of this data from the client or with their permission from NLS.

LAB AND FIELD SECURITY

Lab equipment, field equipment, reagents, empty sample bottles, and filled samples bottles are all items which potentially can become contaminated either maliciously or inadvertently. These items remain in secure custody to insure the legal credibility of analytical results.

Sample Custody in the Field

There are two categories of custody for samples that are collected at various locations and analyzed at Northern Lake Service. The first category includes samples that are collected by Northern Lake Service personnel in whose custody the samples remain until they are received and logged into the database at the lab. The second category of custody occurs when a client collects a sample or set of samples and either makes personal delivery or ships the sample(s) to the laboratory using a public or private courier.

To insure a secure custody of samples collected by NLS personnel, the following policy is followed by NLS field staff during sampling and transportation of samples to the lab:

The names or initials of NLS field personnel are listed on data sheets or field data records. NLS personnel insure that secure custody is maintained by keeping all items either under lock and key or under the direct surveillance of at least one NLS field investigator at all times while in the field. This means that vehicles, buildings, motel rooms, or other locations in which sampling equipment and samples are stored or transported are securely locked whenever unattended by NLS personnel. Whenever the conditions of this policy are not met, a written report explaining the circumstances of non-compliance is required. If the samples had been left in someone else's custody for a period of time, the times and names are recorded. If samples could not or inadvertently were not securely locked up in the absences of NLS personnel, the circumstances will be recorded. Any comments regarding evidence of tampering or whether the attending NLS personnel suspect that the samples may have been tampered with are recorded. This report is signed by all NLS personnel present on that sampling trip and attached to the data to which it pertains in NLS files.

Northern Lake Service assumes no responsibility for sample custody prior to delivery at the lab except when NLS personnel have conducted the sampling and transporting. NLS does provide a chain of custody form for its clients. NLS makes no claims regarding the legal propriety of this form; it was designed to be efficient and minimize paperwork, and to identify all sample custodians. A signature is required by each custodian who is likely to have primary interest in the samples. Transporters are identified only by company name or agency.

Section V of the NLS chain of custody form is completed by NLS personnel when the sample(s) arrive(s) at the lab. A copy is returned to the client with the final data reports for the samples to which it pertains.

Sample Custody in the Laboratory

Once samples are delivered to the laboratory, sample custody is secure by virtue of the fact that no unauthorized persons are allowed in the laboratory. Visitors and service personnel are allowed only under the supervision of NLS personnel. The computerized database is self-contained on the premises. The computer system does not allow anyone to log-in without the proper user-ID and password.

All access doors to NLS are locked at all times when the premises are vacated. All lab reagents, sample bottles, and lab equipment are stored on the premises. Only full time employees are allowed unsupervised access to the laboratory. Lab security is an important consideration whenever new employees are hired. A special secured area within the sample walk-in cooler is provided with locks for clients requiring strict chain of custody and locked storage.

REFERENCES OF METHODOLOGY

All Northern Lake Service analytical, quality control, and preservation methodologies are taken from the following sources:

1. American Public Health Association, et. al. Standard Methods for the Examination of Water and Wastewater. 16th - 20th Editions. American Public Health Association. Washington, D.C.
2. American Society of Testing and Materials, 1995-1999. Annual Book of ASTM Standards - Water and Environmental Technology, Section 11, volume 11.01 - 11.05; ASTM, Philadelphia, PA.
3. American Society of Agronomy, et. al. 1982. Methods of Soil Analysis Part 2 - Chemical and Microbiological Properties. 2nd Edition. Edited by A.L. Page, R.H. Miller, D.R. Keeney. Soil Science Society of American. Madison, Wisconsin.
4. Code of Federal Regulations, Guidelines Establishing Test Procedures for the Analysis of Pollutants Under the Clean Water Act. Final Rule; Title 40, Part 136. Government Printing Office. Washington D.C.
5. Code of Federal Regulations, National Primary Drinking Water Regulations. Final Rule; Title 40, Part 141. Government Printing Office. Washington D.C.
6. Perkin-Elmer. Analytical Methods for Atomic Absorption. 1982 and Updates. Perkin-Elmer Corporation.
7. Technicon Industrial Systems. Technicon Autoanalyzer II Operation Manual. Technicon Instrument Corporation. Tarrytown, New York.
8. United States Environmental Protection Agency, Methods for the Determination of Metals in Environmental Samples. June, 1992. EPA/600/4-91/010. Supplement 1, May, 1994. EPA/600/R-91/111.
9. United States Environmental Protection Agency. Handbook for Analytical Quality Control in Water and Wastewater Laboratories. March, 1979. EPA-600/4-79-019. Revised 1983.
10. United States Environmental Protection Agency. Methods for the Chemical Analysis of Water and Wastes. March, 1983. EPA-600-4-79-020. Government Printing Office. Washington, D.C.
11. United States Environmental Protection Agency. Methods for Organic Analyses of Municipal and Industrial Wastewater. July 1982. EPA-600/4-82-057. Government Printing Office. Washington, D.C.
12. United States Environmental Protection Agency. Test Methods for Evaluating Solid Waste. July, 1982. SW-846. Third Edition and Updates I, II, III and IIIA. Government Printing Office. Washington, D.C.
13. United States Environmental Protection Agency. Methods for the Determination of Organic Compounds in Drinking Water. December 1988. EPA-600/4-88-039, plus Supplements 1 & 2.
14. United States Environmental Protection Agency. Technical Notes on Drinking Water. October 1994. EPA/600/4-94/173.
15. Varian Techtron Pty. LTD. Analytical Methods for Flame Spectroscopy. Varian Techtron, Springvale, Australia.
16. Varian Techtron Pty. LTD. Analytical Methods for Graphite Tube Atomizer. Varian Techtron. Mulgrave Victoria, Australia.
17. United States Environmental Protection Agency. Methods for the Determination of Inorganic Substances in Environmental Samples. August, 1993. EPA-600/R-93/100.

REPORTING DATA

Significant Digits

All results are reported to two significant digits, unless otherwise specified.

Rounding

Digits 6, 7, 8, & 9 are rounded up; 1, 2, 3, & 4 are rounded down. 5's are rounded to the nearest even number; e.g., 4.25 = 4.2; 4.35 = 4.4.

Percent Solids

All Percent Solids results are reported on a Dry Weight basis, unless otherwise specified.

LABORATORY CHEMICALS AND GASES

High quality results are a function of the reagents used. In general, most reagents are of "Analytical Reagent Grade" quality or better. All preservative chemicals meet a minimum quality of ACS analytical grade. All laboratory water used in the analytical methods is reagent grade and appropriate for the specific test. All acids used in graphite furnace analysis are of J.T. Baker Instra-Analyzed quality or better. Acetylene used in atomic absorption is the purified form. Nitrous oxide is U.S. P. grade. Air for atomic absorption analysis is filtered to remove particulates and passed through silica gel to remove moisture prior to its introduction into the atomic absorption spectrophotometers. All chromatography gasses meet a minimum purity of 99.99%.

Standards are purchased or made up by NLS staff. Chemicals used to make standards are of primary standard grade. If purchased, standards are obtained from a reputable supplier. All reagents are dated, and appropriate shelf lives are recorded. Reagents are discarded prior to their expiration date. Matrix modifiers meet ACS Grade. Matrix modifiers for graphite furnace analysis may be extracted with ADPC/MIBK to remove trace metal contaminants. GC gasses are purified using moisture, carbon, and oxygen traps when necessary.

IN-HOUSE BOTTLE CHECK PROCEDURE

New Bottles:

Northern Lake Service utilizes an in-house bottle check procedure to rule out the sample container as a source of contamination. Upon receipt of new sample bottles, each box is given a lot number. Lot numbers are assigned by size of bottle and type of preservative to be used. A random sampling is then pulled from each lot of bottles. These bottles are given a sample number and logged into the database for specific parameters each bottle is used for during analysis. The appropriate preservative along with reagent water is added to each bottle. These samples are then analyzed according to EPA protocol and holding times. If a lot is proven to be contaminated, the whole lot may either be rinsed in the appropriate manner to remove the contamination, not used for that contaminated parameter, or are returned to the manufacturer.

SAMPLE PRESERVATIVE AND HOLDING TIMES

Sample preservation methods are taken from the following sources:

Wisconsin Administrative Code, NR 219, Table F, November 1996, Number 491; Wastewater; and NR 809.725, Tables F, G, and H, October, 1997, No. 502; Drinking Water.

American Public Health Association, et. al., 1995. Standard Methods for the Examination of Water and Wastewater. 20th Edition. American Public Health Association. Washington, D.C.

Storage at low temperature (1 - 4 degrees C) is perhaps the best way to preserve most samples until they can be analyzed. Chemical preservatives are used only when they are shown not to interfere with the analysis being conducted. When used, preservatives are added to the sample bottle initially, so that all sample portions are preserved as soon as collected.

The sample preservative must be chosen with due regard to the determinations to be made. A method of preservation may be hindered when applied to suspended matter.

Methods of preservation are generally intended to retard biological action, retard hydrolysis of chemical compounds and complexes, or reduce volatility of constituents.

Preservation methods are limited to pH control, chemical addition, refrigeration, and freezing. Table I contains holding times and preservation techniques currently employed by Northern Lake Service.

ANALYTICAL RECORDS

The following records are maintained for a minimum of five years by Northern Lake Service:

1. Sample logbook.
2. Sample raw data processed so that any sample may be traced back to the analyst, date collected, date analyzed, method used, raw data, calculations, results and final report.
3. Quality control data for spikes, duplicates, reagent blanks, reference samples, calibration standards, and known standards.
4. Quality control records for precision and accuracy.
5. Instrument maintenance records.
6. Sample preservation checks of in-coming samples.
7. Status of samples on arrival.
8. Log books, bench sheets, and method demonstration.
9. Chain-of-custody.
10. If NLS does the sampling, the following records are kept on file:
 - A. Preservation used.
 - B. Sampling technique.
 - C. Whether sample was equal volume, time-proportionate or composited-proportionate to flow.
 - D. Whether groundwater samples were field filtered, and the pore size diameter of the filter, (i.e., 0.45 μm).
 - E. Any unusual circumstances which may affect result interpretation.
 - F. Field sample results.
 - G. Calibration curves for field instruments, standard conditions, and appropriate maintenance.
 - H. Location and time of sampling.
 - I. Name of sampler.

Analytical methods for the analysis of groundwater, surface water, industrial and municipal wastewater's comply with Wisconsin Statutes NR101, NR140, NR149, NR180, NR181, NR204, NR214, NR219, NR508. NOTE: This section does not address NR 809 Wisconsin Safe Drinking Water statute.

METHODS AND DETECTION LIMITS

In order to insure accurate and consistent results, Northern Lake Service uses methods that have been studied and proven to be reliable by the USEPA. Detection limits used by Northern Lake Service are updated frequently. Detection limits are derived by conducting a replicate analysis with a minimum of seven samples. These samples are spiked and diluted to the proper volume. The samples are digested/extracted (where applicable) and analyzed as if they were an actual sample. The average response and standard deviation is calculated and the method detection limit is calculated as the product of the student t-value times the standard deviation of the test using a 99% confidence level. The reported limit of detection (LOD) is generally the same of these calculated method detection limits (MDLs). The (MDL) detection limits and methods used for each parameter are shown in Table 2. The limit of quantitation (LOQ) for analytical methods, which is the level above which quantitative results may be obtained with a specific degree of confidence, is mathematically defined as equal to 10 times the standard deviation of the results obtained from the MDL analyses. The LOQ is approximately equal to 3.3 times the MDL value.

GENERAL QUALITY CONTROL

Quality assurance in the laboratory has come to mean many things. To some, it is merely equated with such factors as:

1. Adequately trained and experienced personnel.
2. Good physical facilities and equipment.
3. Certified reagents and standards.
4. Frequent servicing and calibration of instruments.
5. Use of replicate and known-addition analysis.

While all of these are important, none in itself assures reliability of laboratory data. A good analytical quality control program consists of three factors:

1. Using only methods that have been studied collaboratively and found acceptable (this generally implies "Standard Methods," EPA, etc.).
2. Routinely analyzing control samples regularly during runs on which unknown samples are being analyzed.
3. Confirming the ability of a laboratory to produce acceptable results by requiring analysis of reference samples several times a year.

Additional considerations which supplement those above, may be designated as internal or statistical quality control, (i.e., control chart trends) as well as external quality control, proficiency testing, or laboratory evaluation.

In the following discussion, internal quality control is emphasized. It is based on a system developed for the control of general production processes and product quality although the same concepts are adapted readily to laboratory operations.

LABORATORY QUALITY CONTROL LIMITS

In industrial applications, control limits are recommended for each product, each machine, and each operator. In the laboratory environment, the parameter of interest, the instrument, and the operator are analogous system variables. However, environmental laboratories routinely have to contend with a variable that has no industrial counterpart - the true concentration level of the parameter of interest, which may vary considerably among samples. Unfortunately, the statistics that work well in industrial applications are sensitive to the variability in true concentration that is found in environmental analysis. This variability in true concentration means that there are no expected values for randomly selected samples, so that the accuracy of testing methodology must be evaluated indirectly through the recovery of known standards and spikes. As a result, it is somewhat difficult to apply industrial quality control techniques to the environmental laboratory.

Accuracy Control Limits

Accuracy is defined as the ability to obtain a result with minimal deviation from the actual amount. Control limits for accuracy are calculated after running a minimum of thirty analyses on spiked samples. The accuracy of the analysis is recorded as percent recovery. Percent recovery (P) can be calculated using the following equation:

$$P = \frac{(\text{observed result} - \text{background})}{(\text{amount of spike})} \times 100\%$$

After collecting a minimum of thirty data points for percent recovery, the average percent recovery (P_a) is calculated using the following equation:

$$P_a = \frac{\Sigma P}{(\text{number of points})}$$

The standard deviation (P_s) is calculated using the following equation:

$$(P_s) = \sqrt{[\Sigma (X_i - X_{\text{avg}})^2 / (n-1)]} \quad \text{where } n = \text{number of points}$$

The warning and control limits are calculated using the following equations:

$$\begin{aligned} \text{Upper Control Limit} &= \text{UCL} = P_a + 3(P_s) \\ \text{Upper Warning Limit} &= \text{UWL} = P_a + 2(P_s) \\ \text{Lower Warning Limit} &= \text{LWL} = P_a - 2(P_s) \\ \text{Lower Control Limit} &= \text{LCL} = P_a - 3(P_s) \end{aligned}$$

During a typical analytical run, one out of ten samples are spiked and analyzed. If the recovery of these samples is out of control, the spiked samples are usually diluted to counteract any matrix effect and reanalyzed until the spiked sample is in control.

Precision Control Limits

Precision is defined as the ability to obtain the same result every time a sample is analyzed. Control limits for precision are calculated after a minimum of thirty analyses on duplicate samples. The precision of the analysis is recorded as the difference in the results of the duplicate samples. The duplicate difference is calculated using the following equation:

$$D = |(\text{Result of 1st Analysis}) - (\text{Result of 2nd Analysis})|$$

Precision of the analysis can also be recorded as percent difference in the results of the duplicate samples. Percent difference ($D_{\%}$) is calculated using the following equation:

$$D_{\%} = \frac{(\text{Result of 1st Analysis}) - (\text{Result of 2nd Analysis})}{(\text{Result of 1st Analysis}) + (\text{Result of 2nd Analysis})} \times 200\%$$

Because the characteristics of precision for samples with a low concentration of analyte as compared to samples with a high concentration of analyte are different, control limits for individual analytes are divided into three ranges of concentrations. Samples with a low concentration of analyte must meet the control limits for the low concentration range. Samples with a high concentration of analyte must meet the control limits for the high concentration range. There is also an intermediate range of analyte concentration. The following is an example of this:

Range 1: 0 - 20 mg/L Maximum Duplicate Difference = 1 mg/L

Range 2: 21 - 40 mg/L Maximum Duplicate Difference = 2 mg/L

Range 3: 41 - 100 mg/L Maximum Duplicate Difference = 3 mg/L

After collecting a minimum of thirty data points for duplicate difference, the average duplicate difference (D_a) for a particular range can be calculated using the following equation:

$$D_a = \frac{\sum D}{(\text{number of points})} \quad \text{where } D = \text{duplicate difference}$$

The standard deviation (D_s) is calculated using the following equation:

$$(D_s) = \sqrt{[\sum (X_i - X_{\text{avg}})^2 / (n-1)]} \quad \text{where } n = \text{number of points}$$

The warning and control limits for a particular concentration range are calculated using the following equations:

$$\begin{aligned}\text{Upper Control Limit} &= \text{UCL} = D_a + 3(D_s) \\ \text{Upper Warning Limit} &= \text{UWL} = D_a + 2(D_s) \\ \text{Lower Warning Limit} &= \text{LWL} = D_a - 2(D_s) \\ \text{Lower Control Limit} &= \text{LCL} = D_a - 3(D_s)\end{aligned}$$

During an analytical run, one out of ten samples are run in duplicate. Many of these duplicate analysis involve the spiking of the samples to provide a non-zero result. If the difference between the duplicate analyses is out of control, the last ten samples are reanalyzed in an attempt to bring the system under control.

Sample Matrix

Since accuracy and precision data is more likely to vary with sample matrix, control limits have been established for the different matrices. There are separate control limits for clean, solid, and waste matrices.

Control Charts and Benchsheets

Accuracy and precision data can be best observed on a control chart. A control chart is a graphical representation of the data. An example of a control chart can be seen in Figure 1. This is a plot of Range 1 duplicate data and accuracy data for (Nitrate + Nitrite) analyzed by EPA method 353.2 (clean matrix).

When benchsheets are printed for an individual parameter, the control limits for that parameter are printed on the first page. Therefore, the analyst knows immediately if a spike or duplicate analysis is out of control.

Computer-Aided Data Entry and Limit Calculation

To assist in the tracking and entry of quality control data, customized computer programs are incorporated into the quality assurance program. Individual analytes are assigned a test code specific to Northern Lake Service requirements. All quality control data make reference to these testcodes. After the completion of every analytical run, the quality control data for that run is entered into the database. Results that exceed control limits are flagged immediately, and the sample batch is reanalyzed. Control limits are automatically recalculated annually. Only those parameters with a minimum of thirty data points are recalculated. All data and past control limits are stored in the new database for ten years.

FIELD SAMPLING QUALITY CONTROL

In addition to laboratory quality control, NLS has standardized field sampling techniques and field quality control. Each time our field sampling crew conducts groundwater sampling, a field equipment check is performed to determine cross contamination between wells.

NLS has devised the following procedure:

1. All equipment is triple rinsed with reagent-grade water. NOTE: This is the standard cleanup procedure between well samples.
2. 500 ml of reagent-grade water is run through the Geofilter pump and filter holder which contain a 0.45 um membrane filter to flush and remove any residual COD, TOC, MBAS, or other trace analytes.
3. An appropriate volume of water is placed in the bailer, filtered through the Geofilter filtering system, and collected into new bottles containing the proper preservatives. These samples are then iced.
4. Appropriate field analyses are run and recorded immediately after sample collection. Examples are conductivity, pH, and temperature.
5. Date, time, weather conditions, etc. are recorded for each sample collected.
6. The field equipment check is logged into the database when received at the lab with all the parameters to be performed on the corresponding samples. This is done to insure there is no possibility of cross-contamination.
7. All meters for field analysis are standardized prior to and after sample collection. Both the pH and conductivity meters are calibrated before sample collection and at four-hour intervals.

Field determination for odor, color, and turbidity on water samples might be expected to vary from observer to observer on the same sample. In an attempt to reduce this variability and produce the most definitive and repeatable results, the terminology shown in Table 3 will be used for these determinations by NLS personnel in the field. All records acquired during field sample collection are kept for a minimum of three years.

ANALYTICAL EQUIPMENT

Northern Lake Service always strives to utilize the most modern equipment available in the environmental analysis field. Many hours of evaluation and testing go into any equipment purchase. The following is a list of analytical equipment used at Northern Lake Service:

1. Technicon Auto Analyzer II.
2. Lachat QuikChem AE Automated Ion Analyzer.
3. Varian Atomic Absorption Spectrometer AA-1475.
4. Perkin Elmer Zeeman Atomic Absorption Spectrometers 4100ZL (two).
5. Thermo Jarrell Ash AtomScan 25 ICP.
6. Thermo Jarrell Ash ICAP 61E Trace Analyzer.
7. Sartorius Analytical Balance.
8. Mettler – Toledo AT200 Analytical Balance.
9. Spectronic Genesys 2 Spectrometer.
10. Blue-M Magni-Whirl Constant Temperature Water Bath (two).
11. American Scientific Products Model DX-38 Drying Oven (three).
12. Thermolyne Model 6000 Laboratory Muffle Furnace.
13. Technicon BD-20/40 Digestion Block and Controller.

14. Orion Model 820 Oxygen Meter.
15. Fisher-Accumet AR40 Dissolved Oxygen Meter.
16. Hach Ratio/XR Turbidimeter.
17. Orion Specific Ion Electrode Meter Model 920A Fluoride, pH/temperature, redox, single/double junction electrodes.
18. Precision Scientific Inc. Steam Bath.
19. Baxter S/P Brand Ultrasonic Cleaners (two).
20. Hewlett Packard 5890 Gas Chromatograph with two Electronic Capture Detectors (PCBs/Pesticides).
21. Hewlett Packard 5890A Gas Chromatograph with two Nitrogen/ Phosphorus Detectors (N/P Pesticides).
22. Hewlett Packard 5890 Series II Gas Chromatograph with two Flame Ionization Detectors (DRO).
23. Varian 3400 Gas Chromatograph with Flame Ionization Detector Photo-Ionization Detector (GRO/PVOC).
24. Varian 3400-CX Gas Chromatograph with Flame Ionization Detector and Photo-Ionization Detector. (GRO/PVOC).
25. Varian 3400 Gas Chromatograph with Flame Ionization Detector (Methanol).
26. Varian 3300 Gas Chromatograph with Photo-Ionization Detector (PVOC).
27. Varian Saturn II GC / Mass Spectrometer (VOC).
28. Varian Saturn III GC / Mass Spectrometer (Drinking Water VOC).
29. Varian Saturn 2000 GC/Mass Spectrometer (VOC).
30. Varian Saturn 2000R GC/Mass Spectrometer (VOC).
31. Tekmar LSC 2000 Purge and Trap with ALS 2016 16-position autosampler (four).
32. Tekmar LSC 3000 Purge and Trap with ALS 2016 16-position autosampler (four).
33. Hewlett Packard High Performance Liquid Chromatograph with 1046A Fluorescence Detector 1040 Diode Array (PAH). Detector , 1050 Autosampler, 1050 Quaternary Pump.
34. Hewlett Packard 3365 Dos Chemstation Software (GC Operating System).
35. Hewlett Packard 3D Win Chemstation for HPLC Software (HPLC Operating System).
36. Hewlett-Packard 5890 Series II Plus Gas Chromatograph/Mass Spectrometer - Series 5972 (Semivolatiles).
37. Lab-Crest MIDI Distillation system.
38. Ohmicron model RPA-1 Spectrophotometer.
39. Lachat Quik Chem Model 8000 Atomic Fluorescence Mercury Analyzer.
40. ABC Gel Permeation Chromatography (GPC) System.
41. Environmental Express "Hot Block" Metals Digestion Block and Controller.
42. Lachat "Astro" Total Organic Carbon Analyzer.
43. Hewlett Packard 5890 Series II+ Gas Chromatograph with Nitrogen/ Phosphorus and Electronic Capture Detectors (PCBs/Pesticides).
44. Bran + Luebbe AutoAnalyzer 3 (Cyanide, Ammonia, Total Kjeldahl Nitrogen).
45. Dionex DX-500 Ion Chromatograph (Anion analyses, Bromide, Chloride, Sulfate).
46. Thermo-Orion Model 960/940 Autotitrator with AS3000 AutoSampler (Alkalinity, Fluoride).
47. Varian Saturn 2100 D GC/MS with CP 8400 AutoSampler (Drinking Water Semi-Volatiles).
48. Leeman Labs' Hydra AF Gold Plus Atomic Fluorescence Analyzer (Ultra-low level Mercury in the 0.05 ppt range).

INSTRUMENT CALIBRATION

Instruments are calibrated or the calibration is verified on the day of analysis. A blank and a minimum of three or more calibration standards is generally used to calibrate every instrument. Some methods allow the use of a continuing calibration check standard to assure the calibration from the previous day is still intact, in which case, the recovery of the check standard must fall within predetermined limits. If this check standard does not meet the limits, the instrument must be recalibrated using a blank and generally at least three calibration standards. The following are summaries of the calibration procedures for all instruments:

1. Furnace Atomic Absorption analysis on Varian AA Furnace:

All standard calibration curves consist of a blank and a minimum of three standards. All samples are analyzed in duplicate. Spikes are analyzed at a ratio of 1 in every 10 samples. A continuing calibration blank (CCB) and a continuing calibration verification (CCV) check sample are reanalyzed after every tenth sample (maximum).

2. Flameless Atomic Absorption for Hg on Varian AA Furnace:

All standard calibration curves consist of the following: A blank and standards at (0.05; 0.10; 0.2; 0.5; and 1.0)

Samples are spiked at a ratio of 1 in every 10 samples; different dilutions are acceptable.

3. Metals by Thermo Jarrel Ash ICP model Atomscan 25:
All standard calibration curves consist of a blank and one calibration standard. All curves are determined within the linear dynamic range of the instrument for each element. All samples are scanned a minimum of three times per element. Duplicate and spikes are analyzed at a ratio of 1 in every 10 samples.
4. Metals by Thermo Jarrel Ash – Trace ICP:
All standard calibration curves consist of a blank and one calibration standard. All curves are determined within the linear dynamic range of the instrument for each element. All samples are scanned a minimum of two times per element. Duplicate and spikes are analyzed at a ratio of 1 in every 10 samples.
5. Metals by Perkin Elmer Zeeman Atomic Absorption Furnace model 4100ZL:
All standard calibration curves consist of a blank and a minimum of three standards run in duplicate. All samples are analyzed in duplicate. Spikes are analyzed at a ratio of 1 in every 10 samples.
6. Mercury by Lachat Model 8000 Quik Chem atomic Fluorescence Mercury Analyzer:
All standard calibration curves consist of a blank and 5 standards. Duplicate spikes are analyzed 1 in every 10 samples. Continuing calibration verifications and blanks are analyzed every 10 samples.
7. Wet chemistry determined on the Technicon AA II & III; and the Lachat Autoanalyzer:
All standard calibration curves consist of a blank and a minimum of three calibration standards run in duplicate. Duplicates and spikes are analyzed at a ratio of 1 in every 10 samples.
8. Ion Chromatography anions are determined using the Dionex DX-500 Ion Chromatograph system:
All standard calibration curves consist of a minimum of four calibration standards run in duplicate. Duplicates, spikes, continuing calibration verification and a blank are analyzed at a ratio of 1 in every 10 samples.
9. Wet chemistry determined on Spectronic Genesys 2 and Bausch & Lomb Spec 88 spectrophotometers:
All standard calibration curves consist of a blank and a minimum of three standards. Duplicates and spikes are analyzed at a ratio of 1 in every 10 samples.
10. Conductivity meter:
Meter standardized using 0.010 Molar solution of Potassium Chloride at 718 Micromhos/cm @ 25° C.
11. pH meter:
Calibrated using a pH 7.00 buffer and one other buffer to bracket the expected sample pH range. The calibration of the meter is verified after every 20th sample and at the end of the pH run. If standards differ by greater than 0.05 pH units from the true concentration, the meter is recalibrated and samples are reanalyzed. A certified pH verification check sample is analyzed with every set of samples.
12. Titrations:
Titration analysis for alkalinity, fluoride and calcium using an autotitrator and autosampler consists of a titrated blank and a 100 mg/L standard as CaCO₃, followed by the samples. Duplicates and spikes are analyzed at a ratio of 1 in every 10 samples.
13. Gasoline Range Organics and PVOCs analyzed on the Varian 3400 and 3400-CX, Gas Chromatograph:
Standard curves consist of a blank and six calibration standards. A continuing calibration is utilized on these instruments for GRO and PVOCs. After the instruments have been initially calibrated, the curves can be used until the check standard recoveries are out of the 80-120% range. Duplicates and spikes are analyzed at a ratio of 1 in every 10 samples. Check standards are analyzed at a minimum of 1 in every 20 samples.
14. Diesel Range Organics run on HP5890A GC:
Standard curves consist of a blank and five calibration standards. A continuing calibration is utilized on this instrument for DRO. After the instrument has been initially calibrated, the curve can be used until the check standard recoveries are out of the 80-120% range. Duplicates, Spikes and Check Standards are analyzed every 20 samples.

15. Polynuclear Aromatic Hydrocarbons (PAHs) run on HP-1050 High Performance Liquid Chromatograph (HPLC):
Standard curves consist of primarily a blank and six calibration standards with five compounds having a seventh standard. A continuing calibration is the middle (1.0 ppm) calibration standard for all compounds with a run log ratio of 1 in 20 or more frequent. After the instrument has been initially calibrated, the curve can be used until the check standard recoveries are out of the 85%-115% range. Sample sets have spike / duplicates at a ratio of 1 set of spike / duplicates per 20 samples including also a set of matrix spike / duplicates per 20 samples
16. PCBs and Pesticides run on HP5890 GC:
Standard curves consist of a blank and five calibration standards. A continuing calibration is utilized on this instrument. After the instrument has been initially calibrated, the curve can be used until the check standard recoveries are out of the 85 - 115 % range. Duplicates and spikes are analyzed at a ratio of one in every 20 samples. Check standards are analyzed at a minimum of one in every ten samples.
17. Safe Drinking Water Act analysis of VOCs run on the Varian Saturn GC/MS:
The standard curve consists of a blank and six calibration standards. A continuing calibration is utilized on this instrument. After the instrument has been initially calibrated, the curve can be used as long as check standard recoveries meet the accuracy criteria of $\pm 30\%$. Check standard frequency is 1 per every 12 hours of analytical time. Additional QC includes one sensitivity standard and one lab fortified blank per every 12-hour batch.
18. VOCs run on Varian Saturn II & Saturn 2000 GC/MSs:
Standard curves consist of a blank and six calibration standards. A continuing calibration is utilized on this instrument. After the instrument has been initially calibrated, the curve can be used until the check standard recoveries are out of the 80-120% range. Duplicates and spikes are analyzed at a minimum of 1 in every 10 samples.
19. Semi-Volatiles analyzed on the Hewlett-Packard GC/MS:
Standard curves consist of a blank and six calibration standards. A continuing calibration is utilized on this instrument. After the instrument has been initially calibrated, and prior to analysis, the initial calibration curve must meet the following requirements: The 13 CCC compounds must have a percent RSD $<30\%$; and SPCC compounds must have an RF > 0.05 . Remaining compounds should have an RSD $< 15\%$ or use a "Higher Order" curve. If the daily Continuing Calibration does not meet the specifications for any of the CCCs and SPCCs, then recalibration may be needed. The CCAL specifications are: 1: CCCs $< 20\%$ difference from ICAL RF and ...2) SPCC > 0.05 RF. The instrument must pass the DFTPP tune specifications given in the method every 12 hours. Duplicate and spike a minimum of 1 in every 10 samples. A total of six surrogates are used for semi-volatiles analyses (three apply to the acid extraction and three apply to the basic extraction).

Calculations performed by NLS staff to reduce raw data into final form are performed by the analyst, and checked by a peer-reviewer). The lab manager periodically spot-checks rough data calculations. The department supervisors review the final report data prior to the data being released in the final reports.

PREVENTATIVE MAINTENANCE

Refrigerators are monitored daily for temperature; the temperature is kept at 1-4 degrees C. The large walk-in refrigerator is continually monitored by computerized sensors and is alarmed to the homes of computer operations staff. The BOD-5 incubator is kept at 20 ± 1 degrees C, and temperature is monitored daily. Glucose / Glutamic acid checks are analyzed daily for BOD. Blanks for BOD should have a depletion drop of <0.20 mg/L. If depletion exceeds 0.20 mg/L, BOD bottles, storage bottles, and dilution water beakers are washed with concentrated chromic acid and rinsed six times with reagent-grade water.

Analytical balances are cleaned frequently and serviced and calibrated annually by E&B Scale. Balances are checked with class S weights when they are used.

Scheduled maintenance is performed on all analytical equipment. Maintenance procedures for individual instruments are performed according to instructions in the specific owner and operation manual for that piece of equipment. Conductivity, pH, and specific ion electrodes are rinsed with reagent grade water after each use. Probes are also cleaned according to cleaning procedure in operation manuals. Records outlining daily measurements are kept for a minimum of three years. The following list outlines the type of measurements recorded:

- | | |
|-----------------------------------------------------|------------------------------------------------------|
| 1. Sample storage refrigeration temperatures. | 2. Standards storage refrigeration temperatures. |
| 3. Laboratory oven temperatures. | 4. Laboratory digestion block temperatures. |
| 5. Standardization of pH and conductivity meters. | 6. Water bath systems temperatures. |
| 7. Turbidity Meter calibration. | 8. Conductivity of reagent grade water. |
| 9. Standardization of field meters. | 10. pH of preserved samples. |
| 11. Calibration of laboratory thermometers. | 12. Sample extraction data and procedures. |
| 13. Sources and lot numbers of standards used. | 14. Maintenance logs for all analytical instruments. |
| 15. Analytical instrument run logs. | 16. Records of computer archived raw data. |
| 17. Room temperatures for TCLP/SPLP leaching tests. | |

LABORATORY INFORMATION MANAGEMENT SYSTEM

In order to efficiently manage the large amount of data produced by an analytical laboratory, Northern Lake Service uses an ARL Revolution 6x6 server operating under the SCO Unix V5.0.2 operating system and an Oracle database Version 7.x. The ARL Revolution 6x6 is a 6 CPU-Pentium Pro 200 mhz server using Raid Level 1 and 5 for file storage. The Raid file storage allows the database to continue to operate during a hard drive failure. Additional backup steps are taken by automatically archiving all database files to DAT tapes nightly. A secondary server is on standby in case of a full hardware failure on the main server. All database access is password protected.

The versatility of the Unix operating system and the Oracle database allows us to conform to the various needs of our customers. Data can be transferred to the customer via disk or email. Data formats can be adjusted so the data may be imported into various types of software. NLS has developed and delivered numerous custom formats to fulfill the needs of our clients.

The database is used in almost every step of the analytical process. After receiving a project from a customer at the laboratory, the samples are logged into the database. The corresponding customer information and analytical parameters to perform on the samples are entered into the database. Sample labels and log-in reports are automatically printed and optionally FAXed to clients. The analysts can then print benchsheets for the individual tests to perform. After completing the analytical run, the analyst enters all results and corresponding quality control information into the database. A list of completed projects is automatically printed every morning. The final reports are then printed for these projects, reviewed, and sent to the client. Quality control limits for all parameters can be calculated on command and are generally recalculated annually. Results for every project are stored in the computer for a minimum of ten years after the receipt of samples. A number of reports can also be run to help in the scheduling process. All customer data is backed up every night onto a tape drive.

ANALYSIS OF QUALITY CONTROL SAMPLES

Laboratory Certification

Northern Lake Service participates in the Wisconsin Laboratory Certification and Registration Program. NLS is currently enrolled and certified through two NVLAP Certified Provider-Performance Evaluation Programs: the Water Supply and the Water Pollution Programs. The Wisconsin Department of Natural Resources grants certification depending on the results of these programs as well as its own WSLH performance evaluation sample program. Certified laboratories must comply with the rules and regulations established in NR149 and 219. Reciprocal laboratory certification has been granted to NLS in the State of Michigan for drinking water analyses.

Performance Evaluation Samples (Reference Samples)

Wisconsin certified laboratories are required to analyze reference samples for each test category in which they wish to be certified. In order to be certified for a test category, the reference sample results must meet the acceptable limits established by the provider. If certification of a test category depends on more than one analyte, the laboratory must have 80% of the results within acceptable limits. For test categories in which reference samples are not required, the laboratory must demonstrate acceptable precision and accuracy based on replicate and spiked sample analysis. Table 4 displays the test categories in which Northern Lake Service is certified.

Blind Standards

Wisconsin certification also requires the analysis of blind standards. Blind standards are administered by the NLS QA Officer and are analyzed a minimum of three times per year. The known amount of analytes and the acceptable ranges are shipped to the QA Officer along with the blind standard ampules. If the result of any test category is not within the acceptable range, corrective action must be taken and the standard must be reanalyzed until the corrective action proves to be successful.

SAFE DRINKING WATER ACT

This section outlines QA/QC required for certification under the Safe Drinking Water Act (SDWA). Wisconsin has addressed the necessary requirements under the Wisconsin administrative code NR809. Except where noted, this section only addresses SDWA protocol.

Sample Handling Procedures for Drinking Water

A chain-of-custody form accompanies all drinking water samples. All such samples are collected in bottles provided by NLS. These bottles come from a certified bottle check lot, and contain the proper preservatives as listed in Table 1. When a sample is received at NLS, whether collected by a client or by NLS staff, it is logged into the Laboratory Database Management Program. When all analyses are complete, a data report is printed, reviewed by the laboratory management, then sent to the client. Completed samples may be discarded by NLS staff three weeks after the final analytical report is mailed to the client.

Sample Collection, Handling, and Preservation procedure:

The sample tap must be representative of the potable water system. The water tap is sampled after maintaining a steady flow for two to three minutes to clear the service line with the exception of copper and/or lead sampling which must a “first draw” sample from a tap not used for a period of at least six hours prior to collection. The sample is taken prior to, or bypassing, any water purification or water softening devices, if possible. The tap must be free of aerator, strainer, and hose attachments. Samples are preserved according to Table 1. Analyses are then completed prior to maximum holding times. When maximum holding times cannot be met, the sample is discarded and a new sample collected. If a Safe Drinking Water Act sample exceeds the maximum contaminant level for a primary drinking water standard parameter, this occurrence is formally communicated to the client.

Safe Drinking Water Methodology

Table 5 contains the approved methodology for drinking water parameters.

TABLE I
SUMMARY OF SPECIAL SAMPLING OR HANDLING REQUIREMENTS

<u>TEST NAME</u>	<u>CONTAINER TYPE</u>	<u>SIZE (ml)</u>	<u>PRESERVATION</u>	<u>REGULATORY HOLDING TIME</u>
Acidity	P,G	100	Refrigerate	14 days
Alkalinity	P,G	200	Refrigerate	14 days
BOD-5	P,G	1000	Refrigerate	48 hrs
Boron	P,G	100	*6	6 months
Bromide	P,G	100	None required	28 days
Carbon, tot. Organic	P,G	250	*4	28 days
Carbon dioxide	P,G	40	None required	Immediately
COD	P,G	100	*4	28 days
Chloride	P,G	30	None required	28 days
Chlorine, Residual	P,G	500	None required	Immediately
Chlorophyll	P,G	500	*2	28 days
Color	P,G	500	Refrigerate	48 hrs
Conductivity	P,G	500	Refrigerate	28 days
Cyanide, tot.	P,G	250	*3	14 days
Fluoride	P	300	None required	28 days
Grease & Oil	G	1000	*10	28 days
Hardness	P,G	100	*6	6 mos
Iodine	P,G	500	None required	Immediately
Metals, except mercury	P(A),G(A)	500	*5, *6	6 mos
Chromium, Hexavalent	P(A),G(A)	300	Refrigerate	24 hrs
Mercury	P(A),G(A)	500	*6	28 days
Mercury, Low-level	G (A)	250	*14	28 days
Nitrogen, Ammonia	P,G	60	*1	28 days
Nitrogen, Nitrite	P,G	100	Refrigerate	48 hrs
Nitrogen, Nitrate	P,G	100	Refrigerate	48 hrs
Nitrogen, NO ₂ +NO ₃	P,G	60	*4	28 days
Nitrogen, TKN	P,G	500	*4	28 days
Odor	G	500	None required	48 hrs
Phenols, (4AAP)	G only	500	*4	28 days
Purgeables, purge & trap	G(C)	40	*9	14 days
Pesticides-GC	G(D)	1000	Refrigerate	E7-A40
Nitrotoluenes	G(D)	1000	Refrigerate	E7-A40
PAHs	G(D)	1000	Refrigerate	E7-A40
Chlorinated Hydrocarbons	G(D)	1000	Refrigerate	E7-A40
DRO (water)	G(D)	1000	*11	E7-A40
DRO (soil)	G(D)	25 g	Refrigerate	E10-A40
GRO (soil)	G(D)	25 g	*12	14 days
GRO (water)	G(D)	40	*13	14 days
Oxygen, dis. (electrode)	G(E)	300	None required	Immediately
pH	P,G	50	None required	2 hrs
Phosphorus, elemental	G	100	Refrigerate	48 hrs
Phosphorus, orthophosphate	P,G	100	*15	48 hrs
Phosphorus, total	P,G	100	*4	28 days
Salinity	G(F)	240	None required	Immediately
Silica	P	50	Refrigerate	28 days
Solids	P,G	250	Refrigerate	7 days
Sulfate	P,G	50	Refrigerate	28 days
Sulfide	P,G	300	*8	7 days
Temperature	P,G	500	None required.	Immediately

Key for Table I - "Sampling and Handling Requirements"

Refrigerate = storage at 4 ° C, in darkness.

P = plastic

G = glass

G(A) = glass, acid rinsed or QA/QC checked

G(B) = glass, borosilicate

G(C) = glass, VOC vial

G(D) = glass, teflon lined cap

G(E) = glass, BOD bottle

G(F) = glass, wax seal

G(S) = glass, rinsed with organic solvents.

E7-A40 = extraction in 7 days, analysis in 40 days.

E10-A40 = extraction in 10 days, analysis in 40 days.

*1 = Analyze immediately, or refrigerate and add H₂SO₄ to pH < 2.

*2 = Filter ASAP and store in dark freezer, analyze within 3 weeks.

*3 = Add NaOH to pH > 12, refrigerate, store in dark.

*4 = Add H₂SO₄ to pH < 2, refrigerate .

*5 = Dissolved metals need to be filtered immediately, prior to preservation .

*6 = Add HNO₃ to pH < 2, refrigerate .

*7 = Analyze as soon as possible, refrigerate, or freeze at 20° C .

*8 = Refrigerate, add 4 drops 2N zinc acetate/100 ml and 10 tablets of NaOH .

*9 = Refrigerate, add 100 mg ascorbic acid if residual Cl present add 1:1 HCL to pH < 2.

*10 = Add HCl to pH < 2, refrigerate.

*11 = Add 5 mLs of 50% HCl, refrigerate.

*12 = Add 25 mLs of P&T Methanol to 25 grams of soil, refrigerate.

*13 = Add (0.5) mLs of 50% HCl, refrigerate.

*14 = Add (2.5) mLs of concentrated HCl, refrigerate.

*15 = Filter immediately (0.45 micron), refrigerate at 4°C

TABLE 2
DETECTION LIMITS AND CORRESPONDING METHODS
**** (Subject to Updates, Dilutional Adjustments and Sample Matrices)****

<u>Parameter</u>	<u>Method Detection</u>		<u>Method</u>
	<u>Limit</u>		
Alkalinity (Buret)	2.5	mg/L	EPA 310.1, 310.2, SM 2320B
Alkalinity (Autotitrater)	1.1	mg/L	EPA 310.2
B.O.D. (5 days)	2.0	mg/L	SM 5210B
Chloride	5.0	mg/L	EPA 300.0
Chromium (Hexavalent)	3.6	ug/L	EPA 7196
C.O.D.	2.6	mg/L	EPA 410.1, SM 5220B
Color (APHA)	5.0	C.P.U.	EPA 110.2
Conductivity	1.0	umhos/cm	EPA 120.1
Cyanide	0.0027	mg/L	EPA 335.4
Cyanide (weak acid)	0.0027	mg/L	EPA 335.4
Dissolved Oxygen	0.5	mg/L	EPA 360.1
Fluoride	0.05	mg/L	EPA 340.2, 4500F-C
Hardness (tot. as CaCO ₃)	2.5/2.0	mg/L	EPA 130.2, 200.7, 6010
Nitrogen, Ammonia	0.025	mg/L	EPA 350.1
Nitrogen, Kjeldahl	0.104	mg/L	EPA 351.2
Nitrogen, Nitrite	0.003	mg/L	SM4500 NO ₂ B
Nitrogen, Nitrate + Nitrite	0.075	mg/L	EPA 353.1, 353.2
Oil & Grease (n-Hexane)	1.06	mg/L	EPA 1664
pH	1	su	EPA 150.1, 9045
Phenol (Distillation 4AAP)	0.05	mg/L	EPA 9065
Phosphorus Total, Dissolved	0.007	mg/L	EPA 365.2, SM 4500P-E
Residue-Total (TS)	2.0	mg/L	EPA 160.3
Residue-Filterable (TDS)	2.0	mg/L	EPA 160.1
Residue-Nonfilterable, (TSS)	1.0	mg/L	EPA 160.2
Residue-Volatile Dissolved, (DVS)	2.0	mg/L	EPA 160.4
Residue-Volatile Total (TVS)	2.0	mg/L	EPA 160.4
Residue-Volatile Suspended, (SVS)	5.0	mg/L	EPA 160.4
Solids-Organic	0.1	%DWB	EPA 160.3
Solids-Percent	0.1	%DWB	EPA 160.3
Sulfate	5.0	mg/L	EPA 300.0
Sulfide	2.0	mg/L	EPA 376.1, SM 4500S ² -E
Total Organic Carbon	0.540	mg/L	EPA 415.1, SM 9060
Turbidity	0.5	NTU	EPA 180.1
<u>Furnace AA Metals (Undigested)</u>			
Antimony	1.69	ug/L	EPA 204.2, 704.1, 3113B
Arsenic	2.64	ug/L	EPA 206.2, 7060, 3113B
Beryllium	0.39	ug/L	EPA 210.2, 7091, 3113B
Cadmium	0.118	ug/L	EPA 213.2, 7131, 3113B
Chromium	0.308	ug/L	EPA 218.2, 7191, 3113B
Copper (SDWA)	12.8	ug/L	EPA 220.1, 7210
Copper	0.398	ug/L	EPA 220.2, 7211, 3113B
Lead	0.546	ug/L	EPA 239.2, 7421, 3113B
Selenium	2.50	ug/L	EPA 270.2, 7740, 3113B
Silver	0.102	ug/L	EPA 272.2, 7761, 3113B
Thallium	1.44	ug/L	EPA 279.2, 7841, 200.9
Mercury, Cold Vapor (Soil)	0.110	mg/Kg	EPA 245.1, 7470, 3112B
Mercury, Standard-Level	50	ng/L	EPA 245.7/163/M
Mercury, Low-Level	15	ng/L	EPA 245.7/163/M
Mercury, Ultra low-level	1.1	ng/L	EPA 245.7/163/M

TABLE 2 CONTINUED: Methods and Detection Limits

<u>Metals by ICP (Undigested)</u>	<u>Method Detection Limit</u>		<u>Method</u>
Aluminum	0.0317	mg/L	EPA 200.7, 6010, 3120B
Barium	0.005	mg/L	EPA 200.7, 6010, 3120B
Beryllium	0.006	mg/L	EPA 200.7, 6010, 3120B
Boron	0.152	mg/L	EPA 200.7, 6010, 3120B
Cadmium	0.0036	mg/L	EPA 200.7, 6010, 3120B
Calcium	0.30	mg/L	EPA 200.7, 6010, 3120B
Chromium	0.0094	mg/L	EPA 200.7, 6010, 3120B
Cobalt	0.0076	mg/L	EPA 200.7, 6010, 3120B
Copper	0.0041	mg/L	EPA 200.7, 6010, 3120B
Iron	0.045	mg/L	EPA 200.7, 6010, 3120B
Lead	0.0878	mg/L	EPA 200.7, 6010, 3120B
Lithium	0.0022	mg/L	EPA 200.7, 6010, 3120B
Magnesium	0.30	mg/L	EPA 200.7, 6010, 3120B
Manganese	0.0029	mg/L	EPA 200.7, 6010, 3120B
Molybdenum	0.0267	mg/L	EPA 200.7, 6010, 3120B
Nickel	0.0187	mg/L	EPA 200.7, 6010, 3120B
Potassium	0.211	mg/L	EPA 200.7, 6010, 3120B
Silver	0.0027	mg/L	EPA 200.7, 6010, 3120B
Sodium	0.033	mg/L	EPA 200.7, 6010, 3120B
Strontium	0.0010	mg/L	EPA 200.7, 6010, 3120B
Thallium	0.0952	mg/L	EPA 200.7, 6010, 3120B
Tin	0.026	mg/L	EPA 200.7, 6010, 3120B
Titanium	0.0133	mg/L	EPA 200.7, 6010, 3120B
Vanadium	0.0047	mg/L	EPA 200.7, 6010, 3120B
Zinc	0.012	mg/L	EPA 200.7, 6010, 3120B
<u>Metals by Trace ICP (Undigested)</u>			
Aluminum	0.0031	mg/L	EPA 200.7, 6010, 3120B
Antimony	1.85	ug/L	EPA 200.7, 6010, 3120B
Arsenic	2.65	ug/L	EPA 200.7, 6010, 3120B
Barium	5.0	ug/L	EPA 200.7, 6010, 3120B
Beryllium	0.17	ug/L	EPA 200.7, 6010, 3120B
Boron	50	ug/L	EPA 200.7, 6010, 3120B
Cadmium	0.226	ug/L	EPA 200.7, 6010, 3120B
Calcium	0.30	mg/L	EPA 200.7, 6010, 3120B
Chromium	0.440	ug/L	EPA 200.7, 6010, 3120B
Cobalt	0.320	ug/L	EPA 200.7, 6010, 3120B
Copper	2.67	ug/L	EPA 200.7, 6010, 3120B
Iron	0.005	mg/L	EPA 200.7, 6010, 3120B
Lead	0.921	ug/L	EPA 200.7, 6010, 3120B
Magnesium	0.30	mg/L	EPA 200.7, 6010, 3120B
Manganese	2.0	ug/L	EPA 200.7, 6010, 3120B
Molybdenum	3.33	ug/L	EPA 200.7, 6010, 3120B
Nickel	0.710	ug/L	EPA 200.7, 6010, 3120B
Selenium	2.6	ug/L	EPA 200.7, 6010, 3120B
Silver	0.472	ug/L	EPA 200.7, 6010, 3120B
Sodium	0.020	mg/L	EPA 200.7, 6010, 3120B
Thallium	2.53	ug/L	EPA 200.7, 6010, 3120B
Vanadium	1.33	ug/L	EPA 200.7, 6010, 3120B
Zinc	10.0	ug/L	EPA 200.7, 6010, 3120B



2D
SOIL SEMIVOLATILE SYSTEM MONITORING COMPOUND RECOVERY

Lab Name: Northern Lake Service

Contract: N/A

Lab Code: NLS

Case No.: N/A

SDG No.: _____

	EPA SAMPLE NO.	SMC1 #	SMC2 #	SMC3 #	SMC4 #	SMC5 #	SMC6 #	TOT OUT
01	0	0 *	0 *	0 *	0 *	0 *	0 *	6
02	0	0 *	0 *	0 *	0 *	0 *	0 *	6
03	0	0 *	0 *	0 *	0 *	0 *	0 *	6
04	0	0 *	0 *	0 *	0 *	0 *	0 *	6
05	0	0 *	0 *	0 *	0 *	0 *	0 *	6
06	0	0 *	0 *	0 *	0 *	0 *	0 *	6
07	0	0 *	0 *	0 *	0 *	0 *	0 *	6
08	0	0 *	0 *	0 *	0 *	0 *	0 *	6
09	0	0 *	0 *	0 *	0 *	0 *	0 *	6
10	0	0 *	0 *	0 *	0 *	0 *	0 *	6
11	0	0 *	0 *	0 *	0 *	0 *	0 *	6
12	0	0 *	0 *	0 *	0 *	0 *	0 *	6
13	0	0 *	0 *	0 *	0 *	0 *	0 *	6
14	0	0 *	0 *	0 *	0 *	0 *	0 *	6
15	0	0 *	0 *	0 *	0 *	0 *	0 *	6
16								

SMC1 (2FP)	=	2-Fluorophenol	QC LIMITS
SMC2 (PHL)	=	Phenol-d5	(37-98)
SMC3 (NBZ)	=	Nitrobenzene-d5	(40-110)
SMC4 (FBP)	=	2-Fluorobiphenyl	(44-117)
SMC5 (TBP)	=	2,4,6-Tribromophenol	(49-120)
SMC6 (TPH)	=	Terphenyl-d14	(24-131)
			(17-146)

Column to be used to flag recovery values
* Values outside of contract required QC limits



3C

WATER SEMIVOLATILE MATRIX SPIKE/MATRIX SPIKE DUPLICATE RECOVERY

Lab Name: Northern Lake ServiceContract: N/ALab Code: NLS Case No.: N/ASAS No.: NA

SDG No.: _____

Matrix Spike - EPA Sample No.:

0

Matrix Spike Duplicate - EPA Sample No.:

0

COMPOUND NAME	SPIKE ADDED (ug/L)	SAMPLE CONC (ug/L)	MS CONCENTRATION (ug/L)	MS % REC	#	QC. LIMITS REC.
Phenol	50	0	0.0	0	*	24-62
2-Chlorophenol	50	0	0.0	0	*	37-100
1,4-Dichlorobenzene	50	0	0.0	0	*	45-94
N-Nitroso-di-n-propylamine	50	0	0.0	0	*	50-103
1,2,4-Trichlorobenzene	50	0	0.0	0	*	56-99
4-Chloro-3-methylphenol	50	0	0.0	0	*	52-109
4-Nitrophenol	50	0	0.0	0	*	0-67
Acenaphthene	50	0	0.0	0	*	67-110
2,4-Dinitrotoluene	50	0	0.0	0	*	63-112
Pentachlorophenol	50	0	0.0	0	*	0-106
Pyrene	50	0	0.0	0	*	67-113

COMPOUND NAME	SPIKE ADDED (ug/L)	SAMPLE CONC (ug/L)	MSD CONCENTRATION (ug/L)	MSD % REC	#	% RPD	#	QC LIMITS RPD REC.
Phenol	50	0	0.0	0	*	#DIV/0!	#	23 24-62
2-Chlorophenol	50	0	0.0	0	*	#DIV/0!	#	23 37-100
1,4-Dichlorobenzene	50	0	0.0	0	*	#DIV/0!	#	22 45-94
N-Nitroso-di-n-propylamine	50	0	0.0	0	*	#DIV/0!	#	22 50-103
1,2,4-Trichlorobenzene	50	0	0.0	0	*	#DIV/0!	#	23 56-99
4-Chloro-3-methylphenol	50	0	0.0	0	*	#DIV/0!	#	20 52-109
4-Nitrophenol	50	0	0.0	0	*	#DIV/0!	#	86 0-67
Acenaphthene	50	0	0.0	0	*	#DIV/0!	#	18 67-110
2,4-Dinitrotoluene	50	0	0.0	0	*	#DIV/0!	#	18 63-112
Pentachlorophenol	50	0	0.0	0	*	#DIV/0!	#	79 0-106
Pyrene	50	0	0.0	0	*	#DIV/0!	#	18 67-113

Column to be used to flag recovery and RPD values with an asterisk

* Values outside of QC limits

RPD: 0 out of 11 outside limits
Spike Recovery: 0 out of 22 outside limits

COMMENTS:



3D
SOIL SEMIVOLATILE MATRIX SPIKE/MATRIX SPIKE DUPLICATE RECOVERY

Lab Name: Northern Lake Service Contract: N/A
Lab Code: NLS Case No.: N/A SAS No.: NA SDG No.:
Matrix Spike - EPA Sample No.: 0
Matrix Spike Duplicate - EPA Sample No.: 0

COMPOUND NAME	SPIKE ADDED (ug/Kg)	SAMPLE CONC (ug/Kg)	MS CONCENTRATION (ug/Kg)	MS % REC	QC. LIMITS REC.
Phenol	1667	0	0.0	0	*26-120
2-Chlorophenol	1667	0	0.0	0	*36-109
1,4-Dichlorobenzene	1667	0	0.0	0	*42-103
N-Nitroso-di-n-propylamine	1667	0	0.0	0	*23-126
1,2,4-Trichlorobenzene	1667	0	0.0	0	*34-117
4-Chloro-3-methylphenol	1667	0	0.0	0	*50-116
4-Nitrophenol	1667	0	0.0	0	*0-136
Acenaphthene	1667	0	0.0	0	*56-117
2,4-Dinitrotoluene	1667	0	0.0	0	*44-123
Pentachlorophenol	1667	0	0.0	0	*4-136
Pyrene	1667	0	0.0	0	*51-114

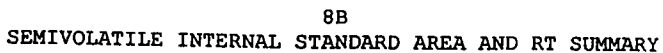
COMPOUND NAME	SPIKE ADDED (ug/L)	SAMPLE CONC (ug/L)	MSD CONCENTRATION (ug/L)	MSD % REC	% RPD	QC LIMITS RPD REC.
Phenol	1667	0	0.0	0	*#DIV/0! #	39 26-120
2-Chlorophenol	1667	0	0.0	0	*#DIV/0! #	24 36-109
1,4-Dichlorobenzene	1667	0	0.0	0	*#DIV/0! #	21 42-103
N-Nitroso-di-n-propylamine	1667	0	0.0	0	*#DIV/0! #	22 23-126
1,2,4-Trichlorobenzene	1667	0	0.0	0	*#DIV/0! #	35 34-117
4-Chloro-3-methylphenol	1667	0	0.0	0	*#DIV/0! #	26 50-116
4-Nitrophenol	1667	0	0.0	0	*#DIV/0! #	46 0-136
Acenaphthene	1667	0	0.0	0	*#DIV/0! #	21 56-117
2,4-Dinitrotoluene	1667	0	0.0	0	*#DIV/0! #	21 44-123
Pentachlorophenol	1667	0	0.0	0	*#DIV/0! #	34 4-136
Pyrene	1667	0	0.0	0	*#DIV/0! #	27 51-114

Column to be used to flag recovery and RPD values with an asterisk

* Values outside of QC limits

RPD: 0 out of 11 outside limits
Spike Recovery: 0 out of 22 outside limits

COMMENTS:



Lab Name:	<u>Northern Lake Service</u>	Contract:	<u>N/A</u>
Lab Code:	<u>NLS</u>	Case No.:	<u>N/A</u>
		SAS No.:	<u>NA</u>
		SDG No.:	<u></u>
Ical Midpoint Std:	<u>SSTD40</u>	Date Analyzed:	<u></u>
Instrument ID:	<u>HP-MSD</u>	Time Analyzed:	<u></u>
GC Column:	<u>RTX-5MS</u>	ID:	<u>0.25 (mm)</u>

IS1 (DCB) = 1,4-Dichlorobenzene-d4
IS2 (NPT) = Naphthalene-d8
IS3 (ANT) = Acenaphthene-d10

AREA UPPER LIMIT = +100% of internal standard area
 AREA LOWER LIMIT = -50% of internal standard area
 RT UPPER LIMIT = +0.50 minutes of internal standard RT
 RT LOWER LIMIT = -0.50 minutes of internal standard RT

Column used to flag values outside QC limits with an asterisk.
* Values outside of QC limits.



8B
SEMIVOLATILE INTERNAL STANDARD AREA AND RT SUMMARY

Lab Name: Northern Lake Service Contract: N/A
Lab Code: NLS Case No.: N/A SAS No.: NA SDG No.:
Ical Midpoint Std: SSTD40 Date Analyzed:
Instrument ID: HP-MSD Time Analyzed:
GC Column: RTX-5MS ID: 0.25 (mm)

	IS4 AREA	#	RT	#	IS5 AREA	#	RT	#	IS6 AREA	#	RT	#
ICAL MIDPOINT STD	0		0		0		0		0		0	
UPPER LIMIT	0		12.78		0		18.14		0		20.89	
LOWER LIMIT	0		11.78		0		17.14		0		19.89	
EPA SAMPLE NO.												
0	0		0.00		0		0.00		0		0.00	
0	0		0.00		0		0.00		0		0.00	
0	0		0.00		0		0.00		0		0.00	
0	0		0.00		0		0.00		0		0.00	
0	0		0.00		0		0.00		0		0.00	
0	0		0.00		0		0.00		0		0.00	
0	0		0.00		0		0.00		0		0.00	
0	0		0.00		0		0.00		0		0.00	
0	0		0.00		0		0.00		0		0.00	
0	0		0.00		0		0.00		0		0.00	
0	0		0.00		0		0.00		0		0.00	
0	0		0.00		0		0.00		0		0.00	
0	0		0.00		0		0.00		0		0.00	
0	0		0.00		0		0.00		0		0.00	
0	0		0.00		0		0.00		0		0.00	
0	0		0.00		0		0.00		0		0.00	
0	0		0.00		0		0.00		0		0.00	

IS4 (PHN) = Phenanthrene-d10
IS5 (CRY) = Chrysene-d12
IS6 (PRY) = Perylene-d12

AREA UPPER LIMIT = +100% of internal standard area
AREA LOWER LIMIT = -50% of internal standard area
RT UPPER LIMIT = +0.50 minutes of internal standard RT
RT LOWER LIMIT = -0.50 minutes of internal standard RT

Column used to flag values outside QC limits with an asterisk.
* Values outside of QC limits.

NORTHERN LAKE SERVICE, INC.

ATTACHMENT 3

LEVEL 4 - QUALITY CONTROL DATA PACKAGE EXAMPLES

TOTAL CYANIDE METHOD 9010 (Soil)

- NLS Analytical Report showing Total Cyanide Analysis on Soil
 - NLS Analytical Bench Sheets for Total Cyanide
- NLS Midi- Cyanide Distillation and Maintenance Logbook Pages
 - NLS Instrument Run Log for Cyanide
 - NLS Technicon AAII Data Report Sheet
 - NLS Technicon AAII Calculation Spreadsheet
- NLS Technicon AAII Analysis – Chart Recording Sheet

ANALYTICAL REPORT

Client: [REDACTED]

Project: [REDACTED]

Soil, 2684, 2681, 2682, 2683 NLS ID: 238155

Ref. Line COC Soil, SD210000.5 Matrix: SO

Collected: 08/23/00 11:45 Received: 08/24/00

Parameter	Result	Units	Dilution	LOD	LOQ	Analyzed	Method	Lab
Arsenic, tot. as As	80	mg/Kg DWB	1	15	54	10/13/00	SW846 6010	721026460
Barium, tot. as Ba	61	mg/Kg DWB	1	0.26*		09/19/00	SW846 6010	721026460
Soil Moisture Content	70.0	%	1			08/31/00	ASTM D2216	721026460
Cadmium, tot. as Cd	2.4	mg/Kg DWB	1	0.34	1.3	09/19/00	SW846 6010	721026460
Chromium, tot. as Cr	23	mg/Kg DWB	1	0.94	3.7	09/19/00	SW846 6010	721026460
Copper, tot. as Cu	21	mg/Kg DWB	1	0.32	1.3	09/19/00	SW846 6010	721026460
Cyanide, tot. (distilled) on solids	ND	mg/Kg DWB	1	0.13	0.45	09/19/00	SW846 6010	721026460
Iron, tot. as Fe	20000	mg/Kg DWB	10	24	95	09/12/00	SW846 9010	721026460
Lead, tot. as Pb	[22]	mg/Kg DWB	1	8.6	34	10/16/00	SW846 6010	721026460
Manganese, tot. as Mn	1200	mg/Kg DWB	10	5.1	20	10/02/00	SW846 6010	721026460
Mercury, total as Hg on solids	[0.17]	mg/Kg DWB	1	0.10	0.32	09/29/00	SW846 6010	721026460
Nickel, tot. as Ni	10	mg/Kg DWB	1	1.1	4.1	09/12/00	SW846 7470A	721026460
Nitrogen, ammonia as N on solids	180	mg/Kg DWB	1	6.4	20	09/19/00	SW846 6010	721026460
Nitrogen, NO2 + NO3 as N on solids	56	mg/Kg DWB	1	6.4	20	09/06/00	SA MTH 33	721026460
Nitrogen, total Kjeldahl as N on solids	5400	mg/Kg DWB	1	72	230	09/06/00	SA MTH 33	721026460
Oil & grease (solid)	2700	mg/Kg DWB	1	360	1200	09/06/00	SA MTH 33	721026460
Phosphorus, as tot. P on solids	0.19	% DWB	1	0.044	0.15	08/30/00	1664 modified	721026460
Selenium, tot. as Se by furnace AAS	ND	mg/Kg DWB	20	1.8	6.3	09/11/00	SM4500-P C	721026460
Solids, total on solids	30.0	%	1	0.10		08/29/00	SW846 7740	721026460
Total organic carbon (TOC) on solids	55000	mg/Kg DWB	1	2300	7300	08/30/00	ASTM D2216	721026460
Zinc, tot. as Zn	90	mg/Kg DWB	1	0.63*		09/08/00	SW846 9060M	113172950
Metals digestion - total soil/sludge ICP	yes					09/19/00	SW846 6010	721026460
Metals digestion - total soil/sludge GF	yes					08/29/00	SW846 3050	721026460

NORTHERN LAKE SERVICE, INC.
Analytical Laboratory and Environmental Services
400 North Lake Avenue - Crandon, WI 54520
Ph: (715)-478-2777 Fax: (715)-478-3060

ANALYTICAL REPORT

WDNR Laboratory ID No. 721026460
WDATCP Laboratory Certification No. 105 000330
EPA Laboratory ID No. WI00034

Printed: 11/20/02 Code: S Page 2 of 6

NLS Project: 56020

NLS Customer: [REDACTED]

Client: [REDACTED]

Project: [REDACTED]

Soil, 2685, 2686, 2687, 2688 NLS ID: 238156

Ref Line COC Soil, SD210002.5 Matrix: SO

Collected: 08/23/00 11:59 Received: 08/24/00

Parameter	Result	Units	Dilution	LOD	LOQ	Analyzed	Method	Lab
Arsenic, tot. as As	340	mg/Kg DWB	1	13	47	10/13/00	SW846 6010	721026460
Barium, tot. as Ba	66	mg/Kg DWB	1	0.23*		09/19/00	SW846 6010	721026460
Soil Moisture Content	67.8	%	1			08/31/00	ASTM D2216	721026460
Cadmium, tot. as Cd	3.3	mg/Kg DWB	1	0.29	1.2	09/19/00	SW846 6010	721026460
Chromium, tot. as Cr	23	mg/Kg DWB	1	0.83	3.3	09/19/00	SW846 6010	721026460
Copper, tot. as Cu	28	mg/Kg DWB	1	0.28	1.1	09/19/00	SW846 6010	721026460
Cyanide, tot. (distilled) on solids	ND	mg/Kg DWB	1	0.12	0.42	09/12/00	SW846 9010	721026460
Iron, tot. as Fe	20000	mg/Kg DWB	10	21	83	10/16/00	SW846 6010	721026460
Lead, tot. as Pb	[23]	mg/Kg DWB	1	7.5	30	10/02/00	SW846 6010	721026460
Manganese, tot. as Mn	1000	mg/Kg DWB	10	4.5	18	09/29/00	SW846 6010	721026460
Mercury, total as Hg on solids	0.43	mg/Kg DWB	1	0.10	0.32	09/12/00	SW846 7470A	721026460
Nickel, tot. as Ni	13	mg/Kg DWB	1	0.93	3.6	09/19/00	SW846 6010	721026460
Nitrogen, ammonia as N on solids	340	mg/Kg DWB	1	6.2	19	09/08/00	SA MTH 33	721026460
Nitrogen, NO2 + NO3 as N on solids	33	mg/Kg DWB	1	6.2	19	09/26/00	SA MTH 33	721026460
Nitrogen, total Kjeldahl as N on solids	4900	mg/Kg DWB	1	64	200	08/30/00	1664 modified	721026460
Oil & grease (solid)	3500	% DWB	1	360	1200	09/11/00	SM4500-P C	721026460
Phosphorus, as tot. P on solids	[0.15]	% DWB	1	0.085	0.30	08/29/00	SW846 7740	721026460
Selenium, tot. as Se by furnace AAS	ND	mg/Kg DWB	20	1.9	6.8	08/30/00	ASTM D2216	721026460
Solids, total on solids	32.2	%	1	0.10		09/08/00	SW846 9060M	113172950
Total organic carbon (TOC) on solids	26000	mg/Kg DWB	-	460	1500	09/19/00	SW846 6010	721026460
Zinc, tot. as Zn	110	mg/Kg DWB	1	0.53*		08/29/00	SW846 3050	721026460
Metals digestion - total soil/sludge ICP	Yes		-			08/29/00	SW846 3050	721026460
Metals digestion - total soil/sludge GF	Yes		-			08/29/00	SW846 3050	721026460

NORTHERN LAKE SERVICE, INC.
Analytical Laboratory and Environmental Services
400 North Lake Avenue - Grandon, WI 54520
Ph: (715)-478-2777 Fax: (715)-478-3060

ANALYTICAL REPORT

WDNR Laboratory ID No. 721026460
WDATCP Laboratory Certification No. 105 000330
EPA Laboratory ID No. W100034

Printed: 11/20/02 Code: S Page 3 of 6

NLS Project: 56020

NLS Customer: [REDACTED]

Client: [REDACTED]

Project: [REDACTED]

[Soil, 2689, 2690, 2691, 2692, NLS ID: 238157]

Ref. Line COC Soil, SD210003.2 Matrix: SO

Collected: 08/23/00 12:03 Received: 08/24/00

Parameter	Result	Units	Dilution	LOD	LOQ	Analyzed	Method	Lab
Arsenic, tot. as As	840	mg/Kg DWB	1	15	52	10/13/00	SW846 6010	721026460
Barium, tot. as Ba	56	mg/Kg DWB	1	0.25*		09/19/00	SW846 6010	721026460
Soil Moisture Content	64.3	%	1			08/31/00	ASTM D2216	721026460
Cadmium, tot. as Cd	3.2	mg/Kg DWB	1	0.32	1.3	09/19/00	SW846 6010	721026460
Chromium, tot. as Cr	23	mg/Kg DWB	1	0.91	3.6	09/19/00	SW846 6010	721026460
Copper, tot. as Cu	39	mg/Kg DWB	1	0.31	1.2	09/19/00	SW846 6010	721026460
Cyanide, tot. (distilled) on solids	ND	mg/Kg DWB	1	0.11	0.37	09/15/00	SW846 6010	721026460
Iron, tot. as Fe	15000	mg/Kg DWB	10	23	91	10/15/00	SW846 6010	721026460
Lead, tot. as Pb	83	mg/Kg DWB	1	8.2	32	10/02/00	SW846 6010	721026460
Manganese, tot. as Mn	580	mg/Kg DWB	1	0.49	1.9	09/29/00	SW846 6010	721026460
Mercury, total as Hg on solids	0.48	mg/Kg DWB	1	0.10	0.32	09/12/00	SW846 7470A	721026460
Nickel, tot. as Ni	14	mg/Kg DWB	1	1.0	4.0	09/19/00	SW846 6010	721026460
Nitrogen, ammonia as N on solids	750	mg/Kg DWB	1	6.1	19	09/06/00	SA MTH 33	721026460
Nitrogen, NO2 + NO3 as N on solids	66	mg/Kg DWB	1	6.1	19	09/06/00	SA MTH 33	721026460
Nitrogen, total Kjeldahl as N on solids	3900	mg/Kg DWB	1	100	310	09/29/00	SA MTH 33	721026460
Oil & grease (solid)	6700	mg/Kg DWB	1	360	1200	08/30/00	1664 modified	721026460
Phosphorus, as tot. P on solids	[0.18]	% DWB	1	0.090	0.32	09/11/00	SM4500-P C	721026460
Selenium, tot. as Se by furnace AAS	ND	mg/Kg DWB	20	1.7	6.1	08/29/00	SW846 7740	721026460
Solids, total on solids	35.7	%	1	0.10		08/30/00	ASTM D2216	721026460
Total organic carbon (TOC) on solids	53000	mg/Kg DWB	1	460	1500	09/08/00	SW846 9060M	113172950
Zinc, tot. as Zn	140	mg/Kg DWB	1	0.60*		09/19/00	SW846 6010	721026460
Metals digestion - total soil/sludge ICP	yes					08/29/00	SW846 3050	721026460
Metals digestion - total soil/sludge GF	yes					08/29/00	SW846 3050	721026460

ANALYTICAL REPORT

Client: [REDACTED]

Project: [REDACTED]

[Soil, 2705, 2706, 2707, 2708, 2396 NLS ID: 238158]
Ref. Line COC Soil, SB210005.2 MS/ Matrix: SO
Collected: 08/23/00 12:35 Received: 08/24/00

Parameter	Result	Units	Dilution	LOD	LOQ	Analyzed	Method	Lab
Arsenic, tot. as As by furnace AAS	[1.4]	mg/Kg DWB	10	0.56	1.9	10/19/00	SW846 7060	721026460
Arsenic, tot. as As	ND	mg/Kg DWB	1	8.0	29	10/13/00	SW846 6010	721026460
Barium, tot. as Ba	22	mg/Kg DWB	1	0.14		09/19/00	SW846 6010	721026460
Soil Moisture Content	4.9	%	1			08/31/00	ASTM D2216	721026460
Cadmium, tot. as Cd	0.75	mg/Kg DWB	1	0.18	0.69	09/19/00	SW846 6010	721026460
Chromium, tot. as Cr	7.4	mg/Kg DWB	1	0.50	2.0	09/19/00	SW846 6010	721026460
Copper, tot. as Cu	8.4	mg/Kg DWB	1	0.17	0.66	09/19/00	SW846 6010	721026460
Cyanide, tot. (distilled) on solids	ND	mg/Kg DWB	1	0.014	0.14	09/15/00	SW846 6010	721026460
Iron, tot. as Fe	8400	mg/Kg DWB	10	13	50	10/16/00	SW846 6010	721026460
Lead, tot. as Pb	[8.6]	mg/Kg DWB	1	4.5	18	10/02/00	SW846 6010	721026460
Manganese, tot. as Mn	180	mg/Kg DWB	1	0.27	1.1	09/29/00	SW846 6010	721026460
Mercury, total as Hg on solids	ND	mg/Kg DWB	1	0.10	0.32	09/12/00	SW846 7470A	721026460
Nickel, tot. as Ni	6.7	mg/Kg DWB	1	0.56	2.2	09/19/00	SW846 6010	721026460
Nitrogen, ammonia as N on solids	78	mg/Kg DWB	1	1.6	5.0	09/06/00	SA MTH 33	721026460
Nitrogen, NO2 + NO3 as N on solids	7.3	mg/Kg DWB	1	1.6	5.0	09/06/00	SA MTH 33	721026460
Nitrogen, total Kjeldahl as N on solids	280	mg/Kg DWB	1	17	53	09/06/00	SA MTH 33	721026460
Oil & grease (solid)	ND	mg/Kg DWB	1	360	1200	08/30/00	1664 modified	721026460
Phosphorus, as tot. P on solids	[0.076]	% DWB	1	0.021	0.076	09/11/00	SM4500-P C	721026460
Selenium, tot. as Se by furnace AAS	ND	mg/Kg DWB	20	0.90	3.2	08/29/00	SW846 7740	721026460
Solids, total on solids	95.1	%	1	0.10		08/30/00	ASTM D2216	721026460
Total organic carbon (TOC) on solids	11000	mg/Kg DWB	1	460	1500	09/08/00	SW846 9060M	113172950
Metals digestion - total soil/sludge ICP	14	mg/Kg DWB	1	0.33		09/19/00	SW846 6010	721026460
Metals digestion - total, soil/sludge GF	Yes		-			08/29/00	SW846 3050	721026460
Zinc, tot. as Zn	Yes		-			08/29/00	SW846 3050	721026460
Metals digestion - total, soil/sludge GF	Yes		-			08/29/00	SW846 3050	721026460

[Soil, 2393, NLS ID: 238159]
Ref. Line COC Soil, SB210007.2 Matrix: SO
Collected: 08/23/00 14:43 Received: 08/24/00

Parameter	Result	Units	Dilution	LOD	LOQ	Analyzed	Method	Lab
Arsenic, tot. as As by furnace AAS	ND	mg/Kg DWB	10	0.75	2.6	10/19/00	SW846 7060	721026460
Arsenic, tot. as As	ND	mg/Kg DWB	1	8.1	29	10/13/00	SW846 6010	721026460
Solids, total on solids	92.2	%	1	0.10		08/30/00	ASTM D2216	721026460
Metals digestion - total soil/sludge ICP	Yes		-			08/30/00	SW846 3050	721026460
Metals digestion - total, soil/sludge GF	Yes		-			10/19/00	SW846 3050	721026460

[Soil, 2394, NLS ID: 238160]
Ref. Line COC Soil, SB210009.2 MS/ Matrix: SO
Collected: 08/23/00 14:52 Received: 08/24/00

Parameter	Result	Units	Dilution	LOD	LOQ	Analyzed	Method	Lab
Arsenic, tot. as As by furnace AAS	[0.93]	mg/Kg DWB	10	0.74	2.5	10/19/00	SW846 7060	721026460
Arsenic, tot. as As	ND	mg/Kg DWB	1	7.7	27	10/13/00	SW846 6010	721026460
Solids, total on solids	92.6	%	1	0.10		08/30/00	ASTM D2216	721026460
Metals digestion - total soil/sludge ICP	Yes		-			08/30/00	SW846 3050	721026460
Metals digestion - total, soil/sludge GF	Yes		-			10/19/00	SW846 3050	721026460

NORTHERN LAKE SERVICE, INC.
Analytical Laboratory and Environmental Services
400 North Lake Avenue - Cranston, WI 54520
Ph: (715)-478-2777 Fax: (715)-478-3060

ANALYTICAL REPORT

WDNR Laboratory ID No. 721028460
WDATCP Laboratory Certification No. 105 000330
EPA Laboratory ID No. WI00034

Printed: 11/20/02 Code: S

Page 5 of 6

NLS Project: 56020

NLS Customer: [REDACTED]

Client: [REDACTED]

Project: [REDACTED]

[Soil, 2395 NLS ID: 238161]
Ref. Line COC Soil, SB210011.2 Matrix: SO
Collected: 08/23/00 15:10 Received: 08/24/00

Parameter						
Arsenic, tot. as As by furnace AAS	Result	Units	Dilution	LOD	LOQ	Lab
Arsenic, tot. as As	[1.5] ND	mg/Kg DWB	10	0.69	2.3	721028460
Solids, total on solids		mg/Kg DWB	1	9.1	32	721028460
Metals digestion - total soil/sludge ICP	90.9	%	1	0.10		721028460
Metals digestion - total soil/sludge GF	yes					721028460
Metals digestion - total soil/sludge GF	yes					721028460
Metals digestion - total soil/sludge GF	yes					721028460

[Soil, 2397 NLS ID: 238162]
Ref. Line COC Soil, SB210013.2 Matrix: SO
Collected: 08/23/00 15:23 Received: 08/24/00

Parameter						
Arsenic, tot. as As by furnace AAS	Result	Units	Dilution	LOD	LOQ	Lab
Arsenic, tot. as As	[0.75] ND	mg/Kg DWB	10	0.69	2.4	721028460
Solids, total on solids		mg/Kg DWB	1	9.7	34	721028460
Metals digestion - total soil/sludge ICP	94.8	%	1	0.10		721028460
Metals digestion - total soil/sludge GF	yes					721028460
Metals digestion - total soil/sludge GF	yes					721028460
Metals digestion - total soil/sludge GF	yes					721028460

[EB015, 2401 NLS ID: 238163]
Ref. Line COC EB015 Matrix: MS
Collected: 08/23/00 15:25 Received: 08/24/00

Parameter						
Arsenic, tot. as As	Result	Units	Dilution	LOD	LOQ	Lab
Metals digestion - total soil/sludge ICP	ND	mg/Kg WWB	1	0.28	1.0	721028460
Metals digestion - total soil/sludge ICP	yes					721028460

[Soil, 2398 NLS ID: 238164]
Ref. Line COC Soil, SB210015.2 Matrix: SO
Collected: 08/23/00 15:32 Received: 08/24/00

Parameter						
Arsenic, tot. as As by furnace AAS	Result	Units	Dilution	LOD	LOQ	Lab
Arsenic, tot. as As	7.5	mg/Kg DWB	10	0.69	2.4	721028460
Solids, total on solids	ND	mg/Kg DWB	1	10	37	721028460
Metals digestion - total soil/sludge ICP	94.2	%	1	0.10		721028460
Metals digestion - total soil/sludge GF	yes					721028460
Metals digestion - total soil/sludge GF	yes					721028460

[Soil, 2399 NLS ID: 238165]
Ref. Line COC Soil, SB210017.2 Matrix: SO
Collected: 08/23/00 15:37 Received: 08/24/00

Parameter						
Arsenic, tot. as As by furnace AAS	Result	Units	Dilution	LOD	LOQ	Lab
Arsenic, tot. as As	ND	mg/Kg DWB	10	0.77	2.6	721028460
Solids, total on solids	ND	mg/Kg DWB	1	9.7	34	721028460
Metals digestion - total soil/sludge ICP	92.5	%	1	0.10		721028460
Metals digestion - total soil/sludge GF	yes					721028460
Metals digestion - total soil/sludge GF	yes					721028460

NORTHERN LAKE SERVICE, INC.
Analytical Laboratory and Environmental Services
400 North Lake Avenue - Crandon, WI 54520
Ph: (715)-478-2777 Fax: (715)-478-3080

ANALYTICAL REPORT

WDNR Laboratory ID No. 721026460
WDATCP Laboratory Certification No. 105 000330
EPA Laboratory ID No. W100034

Printed: 11/20/02 Code: S Page 6 of 6

NLS Project: 56020

NLS Customer: [REDACTED]

Client: [REDACTED]

Project: [REDACTED]

Soil, 2400 NLS ID: 238166
Ref. Line COC Soil, SB210019.2 Matrix: SO
Collected: 08/23/00 15:47 Received: 08/24/00

Parameter	Result	Units	Dilution	LOD	LOQ	Analyzed	Method	Lab
Arsenic, tot. as As by furnace AAS	[1.4]	mg/Kg DWB	10	0.75	2.6	10/19/00	SW846 7060	721026460
Arsenic, tot. as As	ND	mg/Kg DWB	1	9.7	34	10/13/00	SW846 6010	721026460
Solids, total on solids	91.4	%	1	0.10		08/30/00	ASTM D2216	721026460
Metals digestion - total, soil/sludge ICP	yes					08/30/00	SW846 3050	721026460
Metals digestion - total, soil/sludge GF	yes					10/19/00	SW846 3050	721026460

Soil, 2693 NLS ID: 238167
Ref. Line COC Soil, SB210019.2/D Matrix: SO
Collected: 08/23/00 15:47 Received: 08/24/00

Parameter	Result	Units	Dilution	LOD	LOQ	Analyzed	Method	Lab
Arsenic, tot. as As by furnace AAS	[1.1]	mg/Kg DWB	10	0.85	3.0	10/19/00	SW846 7060	721026460
Arsenic, tot. as As	ND	mg/Kg DWB	1	11	39	10/13/00	SW846 6010	721026460
Solids, total on solids	88.6	%	1	0.10		08/30/00	ASTM D2216	721026460
Metals digestion - total, soil/sludge ICP	yes					08/30/00	SW846 3050	721026460
Metals digestion - total, soil/sludge GF	yes					10/19/00	SW846 3050	721026460

Salt Vault Pad, 02402, 02412 NLS ID: 238168
Ref. Line COC Salt Vault Pad Matrix: SW
Collected: 08/23/00 11:53 Received: 08/24/00

Parameter	Result	Units	Dilution	LOD	LOQ	Analyzed	Method	Lab
Arsenic, tot. as As by ICP-Trace	10000	ug/L	10	36	120	10/02/00	EPA 200.7	721026460
Arsenic, dis. as As by ICP-Trace	250	ug/L	10	36	120	10/02/00	EPA 200.7	721026460
Metals digestion - total, water ICP	yes					09/09/00	EPA 200.7	721026460
Metals digestion - dissolved ICP	yes					09/09/00	EPA 200.0	721026460

Values in brackets represent results greater than or equal to the LOD but less than the LOQ and are within a region of "Less-Certain Quantitation". Results greater than or equal to the LOQ are considered to be in the region of "Certain Quantitation". LOD and LOQ tagged with an asterisk(*) are considered Reporting Limits.

LOD = Limit of Detection
DWB = Dry Weight Basis
MCL = Maximum Contaminant Levels for Drinking Water Samples

ND = Not Detected
%DWB = (mg/kg DWB) / 10000
1000 ug/L = 1 mg/L

Reviewed by: _____
Authorized by: R. T. Krueger
President

TYPE: Technicon ID: 860

PAGE: 1
DATE 9/15/80
ANALYST VRF
CHECKED _____
ENTERED _____
SPK CON _____
VER DATE _____
STD DATE _____

LOD:	(NON)	mg/Kg	DWB
LOQ:	(NON)	mg/Kg	DWB
LOD:	(DIG)	mg/Kg	DWB
LOQ:	(DIG)	mg/Kg	DWB

HOLDTIME: 14 days
PAL: ES:

METHODS:	SOP#	
	EPA	EPA 335.3
	SW846	SW846 9010
	ASTM	
	NLS	

ME = 866 S 2

<u>MX</u>	<u>TYPE</u>	<u>UNITS</u>	<u>LOVAL</u>	<u>HIVAL</u>	<u>UCL</u>	<u>MEAN</u>	<u>LCL</u>	<u>DATE</u>
S	DUP	mg/kg	0	2	20.00		.00	
S	DUP	mg/kg	2	20	20.00		.00	
S	DUP	mg/kg	20	1000	20.00		.00	
S	SPK	%	0	200	120.00		80.00	

BLANK (BLK) - CHECKSTANDARD (CHK) - DUPLICATE (DUP) - RECOVERY (SPK) DATA

SAMPLE#	MTRX	TYPE	VALUE1	VALUE2	UNITS	WHO	DATE
237996	S	D	0.1058	0.1058	mg/kg BOD	KRS	9/18/02
238158	S	D	105.1	0.101			
238158	S	D	0.1023				
238158	S	D	102.2				
238158	S	D	0.0940	0.0952			
238158	S	D	93.9				

500447

1902 -- Cyanide, tot. (distilled) on solids

PAGE: 2

PRINTED: 09/11/00 13:14:39

DATE & TIME ANALYZED

9/18/00 1045 RRF

DEFAULT UNITS mg/kg, DWB

===== weight (g) ml % solid mg/kg mol LOR mg/kg DWB

237994 -- 55989 02463 10.1575 90 42.8 0.004 0.091 0.311 (0.09) QC X
MAX: 05-SEP-00 - Soil, SD110000.5 - MTX= SO - 20 d-old 19 d-hse 12:05

237995 -- 55989 02467 10.0129 90 35.2 0.004 0.112 0.303 (0.036) QC X
MAX: 05-SEP-00 - Soil, SD110001.1 - MTX= SO - 20 d-old 19 d-hse 12:45

237996 -- 55989 02491 20.8242 180 86.6 0.004 0.114 0.150 (0.04) QC X
MAX: 05-SEP-00 - Soil, SB206003.1 MS/MSD - MTX= SO - 20 d-old 19 d-hse 12:47

237997 -- 55989 02311 X X X 0.0006 0.0044 0.05 (0.0044) QC X
MAX: 05-SEP-00 - EB014 - MTX= MS - 20 d-old 19 d-hse 13:20

238155 -- 56020 02684 10.0645 90 30.0 0.004 0.132 0.450 (0.012) QC X
MAX: 06-SEP-00 - Soil, SD210000.5 - MTX= SO - 19 d-old 18 d-hse 11:45

238156 -- 56020 02688 10.1186 90 32.2 0.004 0.122 0.440 (0.039) QC X
MAX: 06-SEP-00 - Soil, SD210002.5 - MTX= SO - 19 d-old 18 d-hse 11:59

238157 -- 56020 02682 10.2361 90 35.7 0.0002 0.108 0.309 (0.0019) QC X
MAX: 06-SEP-00 - Soil, SD210003.2 - MTX= SO - 19 d-old 18 d-hse 12:03

*238158 -- 56020 02705 20.8248 180 95.1 0.0002 0.04 0.130 (0.0008) QC X
MAX: 06-SEP-00 - Soil, SB210005.2 MS/MSD - MTX= SO - 19 d-old 18 d-hse 12:35

238341 -- 56051 02585 10.3343 90 45.3 0.004 0.084 0.288 (0.007) QC X
MAX: 07-SEP-00 - Soil, SD208006.5 - MTX= SO - 18 d-old 17 d-hse 09:17

238342 -- 56051 02594 10.1733 90 51.6 0.002 0.015 0.257 (0.003) QC X
MAX: 07-SEP-00 - Soil, SD208007.5 - MTX= SO - 18 d-old 17 d-hse 09:42

238343 -- 56051 02646 20.0103 180 81.6 0.0002 0.015 0.151 (0.002) QC X
MAX: 07-SEP-00 - Soil, SD208008.5 MS/MSD - MTX= SO - 18 d-old 17 d-hse 10:05

238354 -- 56051 02652 10.2044 90 30.3 0.0002 0.028 0.437 (0.006) QC X
MAX: 07-SEP-00 - Soil, SD209006 - MTX= SO - 18 d-old 17 d-hse 15:36

238355 -- 56051 02699 X X X 0.004 0.004 0.015 (0.0044) QC X
MAX: 07-SEP-00 - EB016 - MTX= MS - 18 d-old 17 d-hse 16:57

238356 -- 56051 02683 10.1444 90 93.6 0.004 0.012 0.142 (0.013) QC X
MAX: 07-SEP-00 - Soil, SB209008.5 - MTX= SO - 18 d-old 17 d-hse 16:20

238357 -- 56051 02680 10.0439 90 94.2 0.0002 0.012 0.143 (0.002) QC X
MAX: 07-SEP-00 - Soil, SB209008.5/D - MTX= SO - 18 d-old 17 d-hse 16:20

238642 -- 56099 02760 10.4489 90 16.0 0.0002 0.062 0.212 (0.003) QC X
MAX: 11-SEP-00 - Soil, SD215000.5 - MTX= SO - 14 d-old 12 d-hse 11:31

238643 -- 56099 02763 10.3928 90 46.8 0.0002 0.061 0.276 (0.004) QC X
MAX: 11-SEP-00 - Soil, SD215002.5 - MTX= SO - 14 d-old 12 d-hse 11:56

238644 -- 56099 02723 10.3500 90 57.8
MAX: 11-SEP-00 - Soil, SD215004.5 - MTX= SO - 14 d-old 12 d-hse 12:13

238645 -- 56099 02733 20.1464 180 83.7 0.0002 0.004 0.110 (0.002) QC X
MAX: 11-SEP-00 - Soil, SB215006.5 MS/MSD - MTX= SO - 14 d-old 12 d-hse 16:45

500448

1902 -- Cyanide, tot. (distilled) on solids

PAGE: 3

PRINTED: 09/11/00 13:14:39

DATE & TIME ANALYZED

9/18/00 1045 KRF

DEFAULT UNITS mg/Kg DWB

238656 -- 56099

MAX: 11-SEP-00 -- EBO18 -- MTX = MS -- 14 d-old 12 d-hse 16:53

mg/kg DWB calculation

$\frac{(\text{mg/L})(\text{mL})}{(\text{g})(\% \text{ solids as decimal})}$

MDL $\frac{(0.0044)(\text{mL})}{(\text{g})(\% \text{ solids as decimal})}$

LOQ $\frac{(0.015)(\text{mL})}{(\text{g})(\% \text{ solids as decimal})}$

500449

**NORTHERN LAKE SERVICE
MIDI - CYANIDE DISTILLATION AND
MAINTENANCE LOGBOOK**

BOOK: **200001**
PAGE: _____

Distillation Date: 09/06/00	Start Time: 09:00	Batch Number: 09060001	Distillation Analyst: KRF ✓
------------------------------------	--------------------------	-------------------------------	------------------------------------

Pos. No.	Sample Number	Matrix (WW-T/A, GW DW, Amp.)	Comments / Maintenance	Distillation QC Results	Sulfide Check (✓)	Aldehyde Check (✓)
1	237788	MW302	weak acid		—	—
2	238410	CWS			—	—
3	↓ Spk.	↓	0.5 mL 10 ppm → 50 mL w/p sample		—	—
4	↓ Spk Dup	↓	↓ ↓		—	—
5	238500	Small Paint			—	—
6	238501	Large Paint			—	—
7	238552	Leachate			—	—
8	238585	LEI			—	—
9	Blk	GC			—	—
10	LCS	↓	0.5 mL 10 ppm → 50 mL w/p		—	—

Ansul

Distillation Date: 09/12/00	Start Time: 07:30	Batch Number: 09120001	Distillation Analyst: KRF ✓
------------------------------------	--------------------------	-------------------------------	------------------------------------

Pos. No.	Sample Number	Matrix (WW-T/A, GW DW, Amp.)	Comments / Maintenance	Distillation QC Results	Sulfide Check (✓)	Aldehyde Check (✓)
1	Blk LCS	GC	0.5 mL 10 ppm → 50 mL w/p		—	—
2	LCS 231994	GC SD1/000.5			—	—
3	231995	SD1/000.1			—	—
4	231996	SD2/000.1 MS/MSD			—	—
5	↓ Spk	↓	0.5 mL 10 ppm → 50 mL w/p + sample		—	—
6	↓ Spk Dup	↓	↓ ↓		—	—
7	231997	EB014			—	—
8	238155	Soil SD2/000.5			—	—
9	238156	SD2/000.5			—	—
10	Blk	GC			—	—

**NORTHERN LAKE SERVICE
MIDI - CYANIDE DISTILLATION AND
MAINTENANCE LOGBOOK**

BOOK: **200001**
PAGE: _____

Distillation Date: 09/20/00	Start Time: 1345	Batch Number: 09/20001	Distillation Analyst: KRF
------------------------------------	-------------------------	-------------------------------	----------------------------------

Pos. No.	Sample Number	Matrix (WW-T/A, GW DW, Amp.)	Comments / Maintenance	Distillation QC Results	Sulfide Check (✓)	Aldehyde Check (✓)
1	BK	QC			—	—
2	LCS	↓	0.5ml 10ppm → 250ml w/9		—	—
3	238586	LC2			—	—
4	238723	Headstint			KRF	+
5	238762	Ansul 1001A Gab			—	—
6	239047	Test Well 8B			—	—
7	239409	Leachato 2			—	—
8					—	+
9						
10						

*Ansul

Distillation Date: 09/20/00	Start Time: 0130	Batch Number: 09/50001	Distillation Analyst: KRF
------------------------------------	-------------------------	-------------------------------	----------------------------------

Pos. No.	Sample Number	Matrix (WW-T/A, GW DW, Amp.)	Comments / Maintenance	Distillation QC Results	Sulfide Check (✓)	Aldehyde Check (✓)
1	238511	SD210003.2			—	—
2	BK	QC			—	—
3	LCS	↓	0.5ml 10ppm → 250ml w/9		—	—
4	23858	SB210005.2 MS/KSP			—	—
5	Spk	↓	0.5ml 10ppm → 250ml w/9 + sample		—	—
6	↓ Spk Dup	↓			—	—
7	238341	SD208006.5			—	—
8	238342	SD208007.5			—	—
9	238343	SD208008.5			—	—
10	238354	SD209006			—	—

**NORTHERN LAKE SERVICE
MIDI - CYANIDE DISTILLATION AND
MAINTENANCE LOGBOOK**

BOOK: **200001**
PAGE: _____

Distillation Date: 09/500	Start Time: 1009	Batch Number: 09/50002	Distillation Analyst: KRF
----------------------------------	-------------------------	-------------------------------	----------------------------------

Pos. No.	Sample Number	Matrix (WW-T/A, GW DW, Amp.)	Comments / Maintenance	Distillation QC Results	Sulfide Check (✓)	Aldehyde Check (✓)
1	238355	EB016			—	—
2	238356	SB209005.5			—	—
3	BAK	QC			—	—
4	LIS	↓			—	—
5	238357	SB209005.5/10	0.5mL 10ppm → 75mL w/10		—	—
6	238642	SD21500.5			—	—
7	238643	SD21500.5			—	—
8	238645	SB215006.5			—	—
9	SPK	↓			—	—
10	SPK	↓	0.5mL 10ppm → 50mL w/10 + sample ↓ ↓		—	—

Distillation Date:	Start Time:	Batch Number:	Distillation Analyst:
--------------------	-------------	---------------	-----------------------

Pos. No.	Sample Number	Matrix (WW-T/A, GW DW, Amp.)	Comments / Maintenance	Distillation QC Results	Sulfide Check (✓)	Aldehyde Check (✓)
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						

Run Log

Analyte	Analyst	Date	Cam
Cyanide	KRF	9/18/00 1045	10/4
Method	St. Cal.	File Name	Wavelength
091383	0.22	CL.DPN	570nm
Sample #	QC ID	Sample #	QC ID
1 0.01		1 BLK	
2 0.01		2 BLK	09152002
3 0.05		3 LCS	
4 0.05		4 BLK	
5 0.10		5 238355	
6 0.10		6 238356	
7 0.20		7 238357	
8 0.20		8 238642	
9 BLK		9 238643	
10 BLK		10 BLK	
11 BLK		11 238645	
12 Known	TV=0.10	12 1 Spk	
13 BLK		13 1 Spk	
14 BLK	09120001	14 BLK	
15 LCS		15 Known	TV=0.10
16 BLK		16 BLK	
17 231994		17 238157	
18 231995		18 238158	238341
19 231997		19 238342	
20 238155		20 238343	
21 238156		21 238344	
22 BLK		22 BLK	
23 231996		23 238158	
24 1 Spk		24 1 Spk	
25 1 Spk		25 1 Spk	
26 BLK		26 BLK	
27 BLK	09152001	27 238355	
28 LCS		28 238356	
29 BLK		29 BLK	
30 238157		30 238341	
31 238341		31	
32 238342		32	
33 238343		33	
34 238344		34	
35 BLK		35	
36 238158		36	
37 1 Spk		37	
38 1 Spk		38	
39 BLK		39	
40 Known	TV=0.10	40	

500453

TECHNICON ARII DATA REPORT

Chemistry Name: cyanide
 Raw Data File: cn.prn
 Wavelength: 570
 Cam: 60/4
 Data Acq. (Hz): 5
 DATE CALCULATED: 01-04-1980
 TIME CALCULATED: 12:56:14

All results reported in mg/L

Standards : (-1) means standard was not used for LR calculations

Cup #	Std. Conc.
1	0.010
2	0.010
3	0.050
4	0.050
5	0.100
6	0.100
7	0.200
8	0.200
9	-1.000
10	0.000
11	0.000

Cup #	Std. Conc.	Response	
1	0.010	-2.22	
2	0.010	-2.20	
3	0.050	1.10	
4	0.050	0.90	
5	0.100	4.90	
6	0.100	4.92	
7	0.200	13.07	
8	0.200	13.20	
9	-1.000	-2.93	
10	0.000	-3.02	not used in LR
11	0.000	-3.04	

Correlation Coef: .9998994
 Slope: 80.82374
 Y Intercept: -3.042196

Cup #	y	Response	Final Results
12		0.11	0.039

14	-2.97	0.004
15	-4.05	0.004
16	-3.01	0.098
17	-3.97	0.004
18	-2.98	0.004
19	-2.98	0.004
20	-2.79	0.004
21	-2.98	0.004
22	-2.95	0.004
23	-3.05	0.004
24	-2.93	0.004
25	4.97	0.099
26	4.81	0.097
27	-3.01	0.004
28	-2.97	0.004
29	4.77	0.097
30	-3.02	0.004
31	-0.20	0.035
32	0.93	0.050
33	3.31	0.079
34	2.62	0.070
35	0.94	0.006
36	-0.75	0.028
37	12.67	0.100
38	12.72	0.195
39	11.04	0.174
40	-3.00	0.004
41	-0.13	0.036
42	-3.03	0.004
43	-2.97	0.004
44	4.28	0.091
45	-3.01	0.004
46	1.05	0.061
47	0.53	0.118
48	-3.01	0.004
49	-3.00	0.004
50	-2.91	0.004
51	-3.03	0.004
52	-3.00	0.004
53	3.45	0.080

TECHNICON AAII

Page 3

01 04-1980

Parameter: cyanide

Cup #	Response	Concentration
53	3.96	0.087
54	-3.00	0.004
55	-0.03	0.037
56	-3.03	0.004
57	-1.03	0.018
58	-0.04	0.027
59	-0.01	0.004
60	-0.98	0.004
61	-0.04	0.004
62	0.00	0.004
63	4.06	0.008
64	3.87	0.086
65	-1.01	0.004
66	-0.05	0.004
67	-0.00	0.004
68	-2.93	0.004
69	0.03	0.160
70	3.16	0.004

500455

TECHNICON CALCULATION SPREADSHEET
Created by Tom Herman - Feb. 27, 1990

Cup #	Sample Number	Q.C. I.D.	Response Factor	Conc.	Dilution Factor	Final Conc.
1	0.01		-2.220			
2	0.01		-2.204			
3	0.05		1.095			
4	0.05		0.978			
5	0.10		4.903			
6	0.10		4.923			
7	0.20		13.074			
8	0.20		13.277			
9	0.00		-2.929			0.000
10	0.00		-3.019			0.000
11	0.00		-3.036			0.000
12	known	tv=0.66	0.105	0.039	10.0	0.389
13	blk		-3.036	0.000	1.0	0.000
14	blk	90120001	-2.975	0.001	1.0	0.001
15	lcs		4.852	0.098	1.0	0.098
16	blk		-3.010	0.000	1.0	0.000
17	237994		-2.969	0.001	1.0	0.001
18	237995		-2.977	0.001	1.0	0.001
19	237997		-2.789	0.003	1.0	0.003
20	238155		-2.984	0.001	1.0	0.001
21	238156		-2.949	0.001	1.0	0.001
22	blk		-3.049	-0.000	1.0	-0.000
23	237996		-2.930	0.001	1.0	0.001
24	237996	spk	4.970	0.099	1.0	0.099
25	237996	spk dup	4.805	0.097	1.0	0.097
26	blk		-3.005	0.000	1.0	0.000

* hand
calculated
data
- timing was
off when
the charting
was started
- see chart
for data.

27	blk	9150001	-2.968	0.001	1.0	0.001
28	lcs		4.771	0.097	1.0	0.097
29	blk		-3.018	0.000	1.0	0.000
30	230157		-0.196	0.035	1.0	0.035
31	230341		0.987	0.050	1.0	0.050

500456

34	238354		3.942	0.086	1.0	0.086
35	blk		-0.753	0.028	1.0	0.028
36	238150		5.665	0.108	1.0	0.108
37	238150	spk	12.716	0.195	1.0	0.195
38	238150	spk dup	11.044	0.174	1.0	0.174
39	blk		-3.002	0.000	1.0	0.000
40	known	tv=0.66	-0.132	0.036	10.0	0.360
41	blk		-3.029	0.000	1.0	0.000
42	blk	9150002	-2.972	0.001	1.0	0.001
43	lcs		4.276	0.091	1.0	0.091
44	blk		-3.000	0.000	1.0	0.000
45	238355		1.852	0.061	1.0	0.061
46	238356		6.527	0.118	1.0	0.118
47	238357		-3.010	0.000	1.0	0.000
48	238640		-2.999	0.001	1.0	0.001
49	238640		-2.907	0.002	1.0	0.002
50	blk		-3.029	0.000	1.0	0.000

51	238645		-3.000	0.001	1.0	0.001
52	238645	spk	3.450	0.000	1.0	0.000
53	238645	spk dup	3.965	0.007	1.0	0.007
54	y.blk		-3.003	0.000	1.0	0.000
55	known	tv=0.66	-0.029	0.037	10.0	0.373
56	blk		-3.027	0.000	1.0	0.000
57	238157		-1.508	0.018	1.0	0.018
58	238341		-0.835	0.027	1.0	0.027
59	238342		-2.993	0.001	1.0	0.001
60	238343		-3.011	0.000	1.0	0.000
61	238354		-2.901	0.001	1.0	0.001
62	blk		-3.042	-0.000	1.0	-0.000
63	238150		-2.999	0.001	1.0	0.001
64	238150	spk	4.057	0.000	1.0	0.000
65	238150	spk dup	3.870	0.000	1.0	0.000
66	blk		-3.000	0.000	1.0	0.000

500457

Technicon AA II Analysis - Chart Recording



1- 100 : 9
7- 100 : 9

$\lambda = 0.9999$
 $m = 421.7$

500458

2- 50.0
4- 0.10
5- 0.10
7- 0.10
1- 0.10

8- 0.10

6- 4.8

7- 4.8

11- 4.8

10- 4.8

12- 4.8

13- 4.8

15- 5.0

16- 4.8

17- 4.8

18- 4.8

19- 4.8

20- 4.8

21- 4.8

22- 4.8

23- 4.8

24- 4.8

25- 4.8

26- 4.8

27- 4.8

28- 4.8

29- 4.8

30- 4.8

31- 4.8

32- 4.8

33- 4.8

34- 4.8

24
26

47

47

5.5

5.5

5.5

5.5

5.5

5.5

5.5

6.0

5.5

5.5

5.5

5.5

5.5

5.5

5.5

5.5

5.0

5.0

5.0

5.0

5.0

5.0

5.0

22.5 0.0413 x 100 (0.41) ok

49.5 (0.1046) ok

105.4%

50 (0.1058)

50 (0.1058)

50 (0.1058)

500459

result

500460

97-48 5.5 (0.004)
97-48 5.5 (0.004)
97-48 5.5 (0.004)
97-48 5.5 (0.004)
97-48 5.5 (0.004)

no
sampled
out
✓

NORTHERN LAKE SERVICE, INC.

ATTACHMENT 4

LEVEL 4 - QUALITY CONTROL DATA PACKAGE EXAMPLES

HEXAVALENT CHROMIUM METHOD 7196 (Water)

- NLS Analytical Bench and QC Sheets for Hexavalent Chromium
- NLS Spectrometer Analysis – Calibration and Chart Recording Sheet

Notes

Analyzed: 12-10-74

Analyst M

Checked 1/5MH

Entered _____

#	INSTRUMENT	LOD	LOQ		DL0D	DL0Q	EPA	SW	SM
1	Cr,hex.Cr+6	3.6	3.6	ug/L			SW846 7196A	SW846 7196A	
		06/18/96							

MX	TYPE	UNITS	LOVAL	HIVAL	UCL	UWL	MEAN	LWL	LCL	DATE
C	DUP	ug/L	0	10	14.00	10.48	3.45	-3.59	-7.11	03/15/95
C	DUP	ug/L	10	50	20.00				0.00	
C	DUP	ug/L	50	200	20.00				0.00	
C	SPK	%	0	200	113.85	107.98	96.26	84.53	78.67	03/15/95
LCS	DUP	ug/L	0	10	20.00				0.00	
LCS	DUP	ug/L	10	50	20.00				0.00	
LCS	DUP	ug/L	50	200	20.00				0.00	
LCS	SPK	%	0	200	120.00				80.00	
SC	DUP	ug/L	0	10	20.00				0.00	
SC	DUP	ug/L	10	50	20.00				0.00	
SC	DUP	ug/L	50	200	20.00				0.00	
SC	SPK	%	0	200	120.00				80.00	
W	DUP	ug/L	0	10	9.50	7.24	2.71	-1.82	-4.08	09/29/93
W	DUP	ug/L	10	50	20.76	15.30	4.38	-6.54	-12.01	08/11/01
W	DUP	ug/L	50	100	20.00				0.00	
W	SPK	%	0	200	130.26	116.21	88.11	60.02	45.97	08/11/01

[illegible]

299186 -- 70850

3

40.366
4

44.074
5

≤ 3.6

100.97

Outfall Split Comp - MAX:12/07/02 - MTX:WW - 3.9d-old Od-hse 15:00

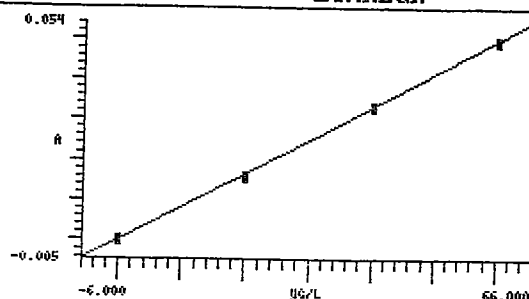
1 VER*10 25.732
2 BOK

257.3 92.7%

6 VER*10 26.957
7 BOK

269.5 97.1%

STANDARD CURVE LINREGR



Slope=0.0008200 Intercept=-0.000
StdDev=0.00031623 Corr.Coeff.=1.000

10 DEC 2002 13:54:46

Application: STANDARD CURVE

Model: LINREGR

Test name: HEXCHROM

ABS Correction: NONE

Wavelength: 540.0

Units: ug/L

Slope=0.0008200 Intercept=-0.000

StdDev=0.00031623 Corr.Coeff.=1.000

ID	ABS	CONC
1	0.021	25.732
ID	ABS	CONC
2	0.000	0.12195
ID	ABS	CONC
3	0.002	2.5610
ID	ABS	CONC
4	0.033	40.366
ID	ABS	CONC
5	0.036	44.024
ID	ABS	CONC
6	0.022	26.951
ID	ABS	CONC
7	0.000	0.12195

NORTHERN LAKE SERVICE, INC.

ATTACHMENT 5

LEVEL 4 - QUALITY CONTROL DATA PACKAGE EXAMPLES

TRACE ICP METALS - METHOD 6010 (Water)

- NLS Trace ICP QC Data Forms for Metals Analysis of Water
 - NLS Analytical Bench Sheets for Trace ICP Metals
- NLS Trace ICP Metals Instrument Calibration / QC / Analysis Printouts



FORM I INORGANIC ANALYSIS DATA SHEET

Lab Name: Northern Lake Service, Inc

SDG No. (project) 56399

Lab Sample I.D.: See final report

Matrix: water

Date Received: See final report

% Solids Not applicable

Date analyzed: 092900

FORM 2A INITIAL AND CONTINUING CALIBRATION VERIFICATION

Initial Calibration Source: SPEX XNLS-3 Lot# 2-40P

Continuing Calibration Peak Perf. QC-21 Lot# 98B056

Concentration Units: ug/L

Analyte	Initial Calibration				Continuing Calibration								M
	True	Found	%R(1)	True	Found	%R(1)	Found	%R(1)	Found	%R(1)	Found	%R(1)	
Ag	1000	1009	100.9	500	506.4	101.3	2505.8	101.2	3503.9	100.8	4449.8	90.0	EPA 6010
As	1000	1017	101.7	500	532.5	106.5	2532.1	106.4	3592.8	110.6	4830.3	166.1	EPA 6010
Ba	1000	993	99.3	500	483.3	97.5	2484.0	96.8	3485.2	97.0	4484.6	96.9	EPA 6010
Cd	1000	1017	101.7	500	527.0	104.4	2520.1	104.0	3525.5	105.1	4526.0	105.3	EPA 6010
Cr	1000	1005	100.5	500	501.1	100.2	2494.7	98.9	3496.3	99.7	4497.3	99.5	EPA 6010
Pb	1000	1009	100.9	500	508.7	101.7	2504.8	101.0	3510.9	102.1	4510.3	102.1	EPA 6010

FORM 2B LOD STANDARD FOR AA AND ICP not applicable

FORM 3 BLANKS

Preparation Blank Matrix: water

Preparation Blank Concentration Units (ug/L)

Analyte	Initial Calib. Blank (ug/L)	Q	Continuing Calibration Blank (ug/L)				Preparation Blank				Batch#	R	Q
			CCB #	Q	CCB #	Q	CCB #	Q	Batch#	R			
Ag	ND		1 ND		2 ND		3 1.630	2.3	77	-	Q	-	Q
As	ND		1 4.880	As 2.204	2 24.56	As 2.204	3 78.62	As 2.204	ND	-	32.93	Prep. Blank	
Ba	ND		1 ND		2 ND		3 ND			-		-	
Cd	ND		1 ND		2 ND		3 ND			-		-	
Cr	ND		1 ND		2 ND		3 ND			-		-	
Pb	ND		1 ND		2 ND		3 ND			-		-	

Comments: 1: Blank value less than 3x IDL

3: Blank value greater than 3x IDL

2: Sample concentration greater than 10x blank concentration

FORM 4 ICP INTERFERENCE CHECK SAMPLE

ICP ID Number: TJA Trace

ICP Source: High Purity CLP INF-1 Lot# 908330

Concentration Units: ug/L

Analyte	True		Initial Found			Final Found		
	Sol.	Sol.	Sol.	Sol.	%R	Sol.	Sol.	%R
	A	AB	A	AB		A	AB	
Ag	NA	500	NA	540.1	108.0	NA	536.3	107.3
As	NA	500	NA	562.1	112.4	NA	636.8	127.4
Ba	NA	500	NA	498.0	99.6	NA	499.7	99.9
Cd	NA	500	NA	492.7	98.5	NA	491.0	98.2
Cr	NA	500	NA	458.7	91.7	NA	449	89.8
Pb	NA	500	NA	484.7	96.9	NA	474.6	94.9

Analyte	Batch#	R	Q
Ag			
As			
Ba			
Cd			
Cr			
Pb			
Analyte	Batch#	R	Q
Ag			
As			
Ba			
Cd			
Cr			
Pb			

FORM 5A SPIKE DUPLICATE dig not applicable to undigested samples

Matrix: water

Level: See below

Concentration Units: ug/L

Analyte	Sample Number	Spike Sample Result (SSR)		Q	Sample Result (SR)	Q	Spike Added (SA)	%R	Q	Method
Ag instr	23866	10030			77.10		100	100.1		EPA 6010
Ag dig							1000			EPA 6010
As instr		11760			461.0		100	113.0		EPA 6010
As dig		11560					1000	111.0		EPA 6010
Ba instr		10340			274		100	103.6		EPA 6010
Ba dig					1066		1000			EPA 6010
Cd instr		11030			77		100	110.1		EPA 6010
Cd dig					6241		1000			EPA 6010
Cr instr		16600			2.56		100	106.0		EPA 6010
Cr dig							1000			EPA 6010
Pb instr		10810			0		100	108.1		EPA 6010
Pb dig							1000			EPA 6010

Ag instr	23866	10030			9.212		100	105.8		EPA 6010
Ag dig							1000	10.3		EPA 6010
As instr		43840			43760		100	130		EPA 6010
As dig		44760					1000			EPA 6010
Ba instr		1167			126.3		100	103.6		EPA 6010
Ba dig		1101					1000	97.5		EPA 6010
Cd instr		1089			3.051		100	108.6		EPA 6010
Cd dig		1044					1000	104.1		EPA 6010
Cr instr		1101			46.23		100	105.5		EPA 6010
Cr dig		1094					1000			EPA 6010
Pb instr		1122			45.42		100	109.3		EPA 6010
Pb dig		1064					1000	106.4		EPA 6010

For Batch 8085 BUC & LFB results
see run 092200
SMH

500008



FORM 5A SPIKE DUPLICATE dig not applicable to undigested samples

Matrix: water

Level: See below

Concentration Units: ug/L

Analyte	Sample Number	Spike Sample Result (SSR)	Q	Sample Result (SR)	Q	Spike Added (SA)	%R	Q	Method
Ag instr	240190	1067		8025		100	98.2		EPA 6010
Ag dig		—		↓		1000	—		EPA 6010
As instr		169300		167100		100	220		EPA 6010
As dig		—		↓		1000	—		EPA 6010
Ba instr		1232		192.1		100	1040		EPA 6010
Ba dig		—		↓		1000	—		EPA 6010
Cd instr		1090		5340		100	108.5		EPA 6010
Cd dig		—		↓		1000	—		EPA 6010
Cr instr		1097		3808		100	105.9		EPA 6010
Cr dig		—		↓		1000	—		EPA 6010
Pb instr		1240		174.1		100	106.6		EPA 6010
Pb dig	↓	—		↓		1000	—		EPA 6010

Ag instr	238168	8971		63.96		100	89.1		EPA 6010
Ag dig	Filtered	—		↓		1000	—		EPA 6010
As instr		12130		20720		100	0	Result N/A	EPA 6010
As dig		108300		↓		1000	0	As	EPA 6010
Ba instr		10520		84.52		100	104.4		EPA 6010
Ba dig		—		↓		1000	—		EPA 6010
Cd instr		10820		1807		100	1080		EPA 6010
Cd dig		—		↓		1000	—		EPA 6010
Cr instr		10400		1991		100	103.8		EPA 6010
Cr dig		—		↓		1000	—		EPA 6010
Pb instr		10640		0		100	106.4		EPA 6010
Pb dig	↓	—		↓		1000	—		EPA 6010

FORM 7 LABORATORY CONTROL SAMPLE (LFB) not applicable to undigested samples

Aqueous LCS Source: High Purity NLS 1 Lot# 015206

Analyte	Aqueous (ug/L)				Aqueous (ug/L)			
	True	Found	%R	Batch #	TRUE	Found	%R	Batch #
Ag	1000	—	—	77	1000	—	—	Q
As	1000	10020	100.2%	↓	1000	10010	100.1%	↓
Ba	1000	—	—	↓	1000	—	—	↓
Cd	1000	—	—	↓	1000	—	—	↓
Cr	1000	—	—	↓	1000	—	—	↓
Pb	1000	—	—	↓	1000	—	—	↓

Ag	1000				1000			
As	1000				1000			
Ba	1000				1000			
Cd	1000				1000			
Cr	1000				1000			
Pb	1000				1000			

500009



FORM 5A

SPIKE DUPLICATE dig not applicable to undigested samples

Matrix: water

Level : See below

Concentration Units: ug/L

Analyte	Sample Number	Spike Sample Result (SSR)	Q	Sample Result (SR)	Q	Spike Added (SA)	%R	Q	Method
Ag instr	239809	553.5		0		100	55.4		EPA 6010
Ag dig		—		↓		1000	—		EPA 6010
As instr		392600		392600		100	140		EPA 6010
As dig		—		↓		1000	—		EPA 6010
Ba instr		1071		40.72		100	163		EPA 6010
Ba dig		—		↓		1000	—		EPA 6010
Cd instr		1082		0.869		100	108.1		EPA 6010
Cd dig		—		↓		1000	—		EPA 6010
Cr instr		1045		10.89		100	103.4		EPA 6010
Cr dig		—		↓		1000	—		EPA 6010
Pb instr		1069		1.692		100	106.7		EPA 6010
Pb dig		—		↓		1000	—		EPA 6010

Ag instr						100			EPA 6010
Ag dig						1000			EPA 6010
As instr						100			EPA 6010
As dig						1000			EPA 6010
Ba instr						100			EPA 6010
Ba dig						1000			EPA 6010
Cd instr						100			EPA 6010
Cd dig						1000			EPA 6010
Cr instr						100			EPA 6010
Cr dig						1000			EPA 6010
Pb instr						100			EPA 6010
Pb dig						1000			EPA 6010

FORM 7

LABORATORY CONTROL SAMPLE (LFB) not applicable to undigested samples

Aqueous LCS Source:

High Purity NLS 1 Lot# 015206

Analyte	Aqueous (ug/L)				Aqueous (ug/L)			
	True	Found	%R	Batch #	TRUE	Found	%R	Batch #
Ag	1000				1000			
As	1000				1000			
Ba	1000				1000			
Cd	1000				1000			
Cr	1000				1000			
Pb	1000				1000			

Ag	1000				1000			
As	1000				1000			
Ba	1000				1000			
Cd	1000				1000			
Cr	1000				1000			
Pb	1000				1000			

500010

ANALYST: CAF SMU DATE PERFORMED: 09/29/00 0500 CHECKED BY: _____

SAMPLE- PROJ#	RUSH	SAMP-DESC	MY	MAXHOLD	COMPANY	BATCH
238168- 56020	no-rush	1 BLK 2103 3 wash	SW	20-SEP-00		77SD
Repeat 10x 100x 100x 6 100x 7 sph / 8 sph / 9 sph / 10 sph						
As						
4 Baten 77 LFB 5 Baten 77 BLK						
239496- 56310	no-rush	00085-00092, 02	GW	09-OCT-00		no
9 168 dig sph 100x 10 168 dig sph 100x						
239675- 56362	no-rush	00128, 00129, 9	GW	10-OCT-00		80f
11 100x Repeat 100x						
As						
239676- 56362	no-rush	00120, 00121, 9	GW	10-OCT-00		80f
12 10x						
Ag As Ba Cd Cr Pb						
239677- 56362	no-rush	00179, 00180, 9	GW	10-OCT-00		80f
13 10x						
Ag As Ba Cd Cr Pb						
239678- 56362	no-rush	00187, 00188, 9	GW	10-OCT-00		80f
14 10x						
Ag As Ba Cd Cr Pb						
239809- 56399	no-rush	00135-139, 00141	GW	11-OCT-00		80SDf
19 809 dig sph 10x 20 809 dig sph 10x						
239810- 56399	no-rush	00103, 00104, 0	GW	11-OCT-00		80
16 10x 17 sph / 18 sph / 19 sph						
Ag As Ba Cd Cr Pb						
239811- 56399	no-rush	00111, 00112, 0	GW	11-OCT-00		no
21 10x						
Ag As Ba Cd Cr Pb						
240054- 56399	no-rush	00157, 00158, 9	GW	11-OCT-00		80f
22 10x						
Ag As Ba Cd Cr Pb						
240190- 56481	no-rush	GW0325, 285, 28	GW	16-OCT-00		80f
24 GC 2117 25 BLK						
240191- 56481	no-rush	GW032M, 297, 29	GW	16-OCT-00		80f
26 10x 27 sph / 28 sph / 29 sph						
Ag As Ba Cd Cr Pb						
240192- 56481	no-rush	GW033S, 304, 30	GW	16-OCT-00		80
29 10x						
Ag As Ba Cd Cr Pb						
240193- 56481	no-rush	GW033M, 312, 31	GW	16-OCT-00		80f
30 10x						
Ag As Ba Cd Cr Pb						
240345- 56515	no-rush	CL1	GW	12-OCT-00		no
31 10x						
Ag As Ba Cd Cr Pb						
240346- 56515	no-rush	CB7	GW	11-OCT-00		no
B Ba Cd Fe Mn Na Pb						
B Ba Cd Fe Mn Na Pb						

Arsenic ICS Failed at the end of

Run is reset all Arsenics

500011

ANALYST: SmuDATE PERFORMED: 09/29/00

CHECKED BY: _____

SAMPLE- PROJ#	RUSH	SAMP-DESC	MX	MAXHOLD	COMPANY	BATCH	
238168- 56020	no-rush	Salt Vault Pad, SW	20-SEP-00			QSD	34 100x 35sp/36sp/100x
		32 Batch Q LFB		33 Batch Q BUC			As
#00092 239496- 56310	no-rush	00085-00092, 02	GW	09-OCT-00		no	39 100x
		37 168F dig spm 100x		38 168 dig spm 100x			As
#00134 239675- 56362	no-rush	00128, 00129, 9	GW	10-OCT-00		no	40 10x
							Ag As Ba Cd Cr Pb
#00176 239676- 56362	no-rush	00120, 00121, 9	GW	10-OCT-00		no	41 10x
							Ag As Ba Cd Cr Pb
#00185 239677- 56362	no-rush	00179, 00180, 9	GW	10-OCT-00		no	42 10x
							Ag As Ba Cd Cr Pb
#00193 239678- 56362	no-rush	00187, 00188, 9	GW	10-OCT-00		no	43 10x
							Ag As Ba Cd Cr Pb
#00151 239809- 56399	no-rush	00135-139, 00141	GW	11-OCT-00		no	46 10x 47sp/48sp/100x
		44 QC 2117		45 BUC			Ag As Ba Cd Cr Pb
#00182 239810- 56399	no-rush	00103, 00104, 0	GW	11-OCT-00		no	49 10x
							Ag As Ba Cd Cr Pb
#00112 239811- 56399	no-rush	00111, 00112, 0	GW	11-OCT-00		no	50 10x
							Ag As Ba Cd Cr Pb
#00160 240054- 56399	no-rush	00157, 00158, 9	GW	11-OCT-00		no	51 10x
							Ag As Ba Cd Cr Pb
#00190 240190- 56481	no-rush	GW0325, 285, 28	GW	16-OCT-00		Sf	52 10x
							Ag As Ba Cd Cr Pb
#00191 240191- 56481	no-rush	GW032M, 297, 29	GW	16-OCT-00		no	53 10x
							Ag As Ba Cd Cr Pb
#00192 240192- 56481	no-rush	GW033S, 304, 30	GW	16-OCT-00		no	54 10x
							Ag As Ba Cd Cr Pb
#00193 240193- 56481	no-rush	GW033M, 312, 31	GW	16-OCT-00		no	55 10x
		56 QC 2117		57 BUC			Ag As Ba Cd Cr Pb
240349- 56516	no-rush	W-16	GW	16-OCT-00		no	
							Cr Fe Ni
240350- 56516	no-rush	W-4	GW	16-OCT-00		no	
							Cr Fe Ni
240351- 56516	no-rush	W-6	GW	16-OCT-00		no	
							Cr Fe Ni

500012

Method: TRACE Sample Name: blank

Run Time: 09/29/98 05:42:48

Comment:

Operator:

Mode: CONC Corr. Factor: 1

Elem	Ag3280	Al2373	As1890	B_2496	Ba4934	Be3130	Ca3179
Units	ppb	ppm	ppb	ppb	ppb	ppb	ppm
Avge	1.851	.0024	.2941	-.4132	-.0898	-.0897	.0020
SDev	2.877	.0025	1.788	.0247	.0358	.0465	.0006
%RSD	155.4	105.5	608.0	5.966	39.82	51.84	30.25

#1	-.1834	.0041	-.9703	-.4306	-.0645	-.1226	.0024
#2	3.885	.0006	1.558	-.3958	-.1151	-.0568	.0016

Elem	Cd2265	Co2286	Cr2677	Cu3247	FE	Mg2790	Mn2576
Units	ppb	ppb	ppb	ppb	ppm	ppm	ppb
Avge	-.1138	-.2168	.3772	.4666	-.0006	-.0037	-.0176
SDev	.0613	.2894	.2605	.7253	.0001	.0068	.0791
%RSD	53.84	133.5	69.07	155.4	20.72	184.8	450.9

#1	-.1571	-.0122	.5614	.9795	-.0005	.0011	.0384
#2	-.0705	-.4214	.1930	-.0462	-.0006	-.0085	-.0735

Elem	Na	Ni2316	2203/1	2203/2	Se1960	Pb2203	Sb2068
Units	ppm	ppb	ppb	ppb	ppb	ppb	ppb
Avge	-.0079	-.1057	4.233	-1.096	-.4469	.6791	1.635
SDev	.0025	.1130	4.468	1.866	.1744	.2431	.411
%RSD	32.00	106.9	105.6	170.4	39.02	35.79	25.13

#1	-.0061	-.1856	1.074	.2242	-.3236	.5072	1.345
#2	-.0097	-.0258	7.393	-2.415	-.5703	.8510	1.926

Elem	1960/1	1960/2	Tl1908	V_2924	Zn2138
Units	ppb	ppb	ppb	ppb	ppb
Avge	-5.289	1.970	-3.764	-.5232	.5869
SDev	5.833	3.174	.699	.0065	.1420
%RSD	110.3	161.1	18.58	1.241	24.20

#1	-9.413	4.214	-4.259	-.5278	.6873
#2	-1.164	-.2738	-3.270	-.5186	.4865

IntStd	1	2	3	4	5	6	7
Mode	Counts	NOTUSED	NOTUSED	NOTUSED	NOTUSED	NOTUSED	NOTUSED
Elem	Y	--	--	--	--	--	--
Wavlen	371.030	--	--	--	--	--	--
Avge	40721	--	--	--	--	--	--
SDev	3175.965	--	--	--	--	--	--
%RSD	7.799353	--	--	--	--	--	--

#1	38475	--	--	--	--	--	--
#2	42967	--	--	--	--	--	--

Method: TRACE Standard: STD1-Blank

500013

Elem	Ag3280	Al2373	As1890	B_2496	Ba4934	Be3130	Ca3179
------	--------	--------	--------	--------	--------	--------	--------

Avge	-.0134	-.0008	.0004	.0023	-.0007	-.0161	.0053
------	--------	--------	-------	-------	--------	--------	-------

#1	6.716	2.153	12.82	1.678	5.758	7.442	5.147
#2	6.740	2.145	12.86	1.684	5.789	7.434	5.160

Elem	Sb2068	1960/1	1960/2	Tl1908	V_2924	Zn2138
Avge	2.635	1.553	1.643	1.138	.3966	4.257
SDev	.012	.006	.008	.006	.0008	.015
%RSD	.4567	.4152	.4789	.5440	.1969	.3441

#1	2.627	1.549	1.648	1.134	.3960	4.247
#2	2.644	1.558	1.637	1.142	.3971	4.268

IntStd	1	2	3	4	5	6	7
Mode	Counts	NOTUSED	NOTUSED	NOTUSED	NOTUSED	NOTUSED	NOTUSED
Elem	Y	--	--	--	--	--	--
Wavlen	371.030	--	--	--	--	--	--
Avge	34323	--	--	--	--	--	--
SDev	673.8120	--	--	--	--	--	--
%RSD	1.963176	--	--	--	--	--	--

#1	34799	--	--	--	--	--	--
#2	33846	--	--	--	--	--	--

Method: TRACE Standard: INT A-1

Elem	Al2373	Ca3179	Mg2790
Avge	18.77	10.26	13.41
SDev	.01	.01	.00
%RSD	.0373	.0564	.0347

#1	18.78	10.26	13.41
#2	18.77	10.27	13.41

IntStd	1	2	3	4	5	6	7
Mode	Counts	NOTUSED	NOTUSED	NOTUSED	NOTUSED	NOTUSED	NOTUSED
Elem	Y	--	--	--	--	--	--
Wavlen	371.030	--	--	--	--	--	--
Avge	31736	--	--	--	--	--	--
SDev	235.9969	--	--	--	--	--	--
%RSD	.7436224	--	--	--	--	--	--

#1	31903	--	--	--	--	--	--
#2	31569	--	--	--	--	--	--

Method: TRACE Standard: ODD-H

Elem	FE	Na
Avge	12.93	1.946
SDev	.01	.004
%RSD	.0721	.2033

#1	12.94	1.943
#2	12.92	1.949

IntStd	1	2	3	4	5	6	7
--------	---	---	---	---	---	---	---

500015

Mode	Counts	NOTUSED	NOTUSED	NOTUSED	NOTUSED	NOTUSED	NOTUSED
Elem	Y	--	--	--	--	--	--
Wavlen	371.030	--	--	--	--	--	--
Avge	29702	--	--	--	--	--	--
SDev	221.9956	--	--	--	--	--	--
%RSD	.7474017	--	--	--	--	--	--
#1	29545	--	--	--	--	--	--
#2	29859	--	--	--	--	--	--

Method: TRACE Standard: ODD-L

Elem	Na
Avge	12.04
SDev	.02
%RSD	.2036

#1	12.06
#2	12.03

IntStd	1	2	3	4	5	6	7
Mode	Counts	NOTUSED	NOTUSED	NOTUSED	NOTUSED	NOTUSED	NOTUSED
Elem	Y	--	--	--	--	--	--
Wavlen	371.030	--	--	--	--	--	--
Avge	33288	--	--	--	--	--	--
SDev	44.36266	--	--	--	--	--	--
%RSD	.1332672	--	--	--	--	--	--
#1	33320	--	--	--	--	--	--
#2	33257	--	--	--	--	--	--

Method: TRACE Slope = Conc(SIR)/IR

Element	Wavlen	High std	Low std	Slope	Y-intercept	Date Standardized
Ag3280	328.068	X-NLS 3	STD1-Blank	322.073	4.31507	09/29/98 06:16:28
Al2373	237.313	INT A-1	STD1-Blank	5.32687	.004229	09/29/98 06:16:28
As1890	189.042	X-NLS 3	STD1-Blank	832.650	-.365259	09/29/98 06:16:28
B_2496	249.678	X-NLS 3	STD1-Blank	334.898	-.757743	09/29/98 06:16:28
Ba4934	493.409	X-NLS 3	STD1-Blank	43.8477	.031686	09/29/98 06:16:28
Be3130	313.042	X-NLS 3	STD1-Blank	31.6308	.509183	09/29/98 06:16:28
Ca3179	317.933	INT A-1	STD1-Blank	9.74697	-.051245	09/29/98 06:16:28
Cd2265	226.502	X-NLS 3	STD1-Blank	41.5152	.099925	09/29/98 06:16:28
Co2286	228.616	X-NLS 3	STD1-Blank	402.451	.429818	09/29/98 06:16:28
Cr2677	267.716	X-NLS 3	STD1-Blank	148.677	-.271036	09/29/98 06:16:28
Cu3247	324.753	X-NLS 3	STD1-Blank	469.343	-8.65342	09/29/98 06:16:28
FE	271.441	ODD-H	STD1-Blank	7.73376	.002782	09/29/98 06:16:28
FE	259.940	X-NLS 3	STD1-Blank	.778791	-.001320	09/29/98 06:16:28
Mg2790	279.078	INT A-1	STD1-Blank	7.45623	.003135	09/29/98 06:16:28
Mn2576	257.610	X-NLS 3	STD1-Blank	594.907	-.087834	09/29/98 06:16:28
Na	588.995	ODD-L	STD1-Blank	.418085	-.035560	09/29/98 06:16:28
Na	330.223	ODD-H	STD1-Blank	1.23219	-.000294	09/29/98 06:16:28
Ni2316	231.604	X-NLS 3	STD1-Blank	173.079	.756444	09/29/98 06:16:28
2203/1	220.351	X-NLS 3	STD1-Blank	134.850	-2.98436	09/29/98 06:16:28

500016

Element	Wavelen	High std	Low std	Slope	Y-intercept	Date Standardized
2203/2	220.352	X-NLS 3	STD1-Blank	193.858	1.02339	09/29/98 06:16:28
Se1960	196.026	NONE	NONE	1.00000	.000000	*09/29/98 06:16:28
Pb2203	220.353	NONE	NONE	1.00000	.000000	*09/29/98 06:16:28
Sb2068	206.838	X-NLS 3	STD1-Blank	380.866	-3.68841	09/29/98 06:16:28
1960/1	196.021	X-NLS 3	STD1-Blank	639.053	7.48145	09/29/98 06:16:28
1960/2	196.022	X-NLS 3	STD1-Blank	613.527	-7.71905	09/29/98 06:16:28
Tl1908	190.864	X-NLS 3	STD1-Blank	872.400	7.13228	09/29/98 06:16:28
V_2924	292.402	X-NLS 3	STD1-Blank	2517.69	1.56183	09/29/98 06:16:28
Zn2138	213.856	X-NLS 3	STD1-Blank	234.920	-.168483	09/29/98 06:16:28

Method: TRACE Sample Name: xnls-3
Run Time: 09/29/98 06:19:25
Comment:
Mode: CONC Corr. Factor: 1

Operator:

Elem	Ag3280	Al2373	As1890	B_2496	Ba4934	Be3130	Ca3179
Units	ppb	ppm	ppb	ppb	ppb	ppb	ppm
Avg	1009.	9.644	1017.	10110.	993.0	1008.	.0125
SDev	.004	.004	.0024	.0900	.0440	.0981	.0085
%RSD	.0486	.0396	.0024	.0900	.0440	.0981	67.95

#1	1009.	9.641	1017.	10100.	993.3	1009.	.0065
#2	1008.	9.647	1017.	10110.	992.7	1008.	.0185

Elem	Cd2265	Co2286	Cr2677	Cu3247	FE	Mg2790	Mn2576
Units	ppb	ppb	ppb	ppb	ppm	ppm	ppb
Avg	1012.	1007.	1005.	989.6	9.971	.0143	1006.
SDev	1.	1.	2.	.0	.010	.0063	1.
%RSD	.1303	.1416	.1609	.0011	.0985	44.34	.1150

#1	1013.	1008.	1006.	989.6	9.964	.0098	1007.
#2	1011.	1006.	1004.	989.6	9.978	.0187	1005.

Elem	Na	Ni2316	2203/1	2203/2	Se1960	Pb2203	Sb2068
Units	ppm	ppb	ppb	ppb	ppb	ppb	ppb
Avg	.0619	1006.	1012.	1008.	1024.	1009.	1005.
SDev	.0428	.	10.	3.	3.	5.	3.
%RSD	69.11	.0276	.9413	.3250	.2747	.5308	.2859

#1	.0316	1007.	1019.	1010.	1026.	1013.	1007.
#2	.0921	1006.	1006.	1006.	1022.	1006.	1003.

Elem	1960/1	1960/2	Tl1908	V_2924	Zn2138
Units	ppb	ppb	ppb	ppb	ppb
Avg	1020.	1026.	1002.	1005.	1014.
SDev	6.	1.	3.	.	1.
%RSD	.5672	.1297	.2649	.0280	.0723

#1	1024.	1027.	1004.	1005.	1014.
#2	1015.	1025.	999.8	1005.	1013.

IntStd	1	2	3	4	5	6	7
Mode	Counts	NOTUSED	NOTUSED	NOTUSED	NOTUSED	NOTUSED	NOTUSED
Elem	Y	--	--	--	--	--	--
Wavlen	371.030	--	--	--	--	--	--

500017

Avge	31479	--	--	--	--	--	--
SDev	122.3350	--	--	--	--	--	--
%RSD	.3886273	--	--	--	--	--	--
#1	31392	--	--	--	--	--	--
#2	31565	--	--	--	--	--	--

Method: TRACE Sample Name: int-a1 Operator:
Run Time: 09/29/98 06:25:28
Comment:
Mode: CONC Corr. Factor: 1

Elem	Al2373	Ca3179	Mg2790
Units	ppm	ppm	ppm
Avge	99.81	99.14	99.63
SDev	.11	.11	.13
%RSD	.1149	.1081	.1309

#1	99.72	99.06	99.54
#2	99.89	99.22	99.73

IntStd	1	2	3	4	5	6	7
Mode	Counts	NOTUSED	NOTUSED	NOTUSED	NOTUSED	NOTUSED	NOTUSED
Elem	Y	--	--	--	--	--	--
Wavlen	371.030	--	--	--	--	--	--
Avge	29921	--	--	--	--	--	--
SDev	117.9045	--	--	--	--	--	--
%RSD	.3940520	--	--	--	--	--	--

#1	29838	--	--	--	--	--	--
#2	30004	--	--	--	--	--	--

Method: TRACE Sample Name: odd-h Operator:
Run Time: 09/29/98 06:29:56
Comment:
Mode: CONC Corr. Factor: 1

Elem	FE	Na
Units	ppm	ppm
Avge	100.8	196.8
SDev	.0	1.1
%RSD	.0081	.5555

#1	100.8	197.5
#2	100.8	196.0

IntStd	1	2	3	4	5	6	7
Mode	Counts	NOTUSED	NOTUSED	NOTUSED	NOTUSED	NOTUSED	NOTUSED
Elem	Y	--	--	--	--	--	--
Wavlen	371.030	--	--	--	--	--	--
Avge	30273	--	--	--	--	--	--
SDev	50.53742	--	--	--	--	--	--
%RSD	.1669398	--	--	--	--	--	--

#1	30237	--	--	--	--	--	--
----	-------	----	----	----	----	----	----

500018

#2 30309 -- -- -- -- --

Method: TRACE Sample Name: odd-1
Run Time: 09/29/98 06:33:24
Comment:
Mode: CONC Corr. Factor: 1

Operator:

Elem Na
Units ppm
Avge 5.105
SDev .133
%RSD 2.611

#1 5.199
#2 5.011

IntStd	1	2	3	4	5	6	7
Mode	Counts	NOTUSED	NOTUSED	NOTUSED	NOTUSED	NOTUSED	NOTUSED
Elem	Y	--	--	--	--	--	--
Wavlen	371.030	--	--	--	--	--	--
Avge	33284	--	--	--	--	--	--
SDev	25.41165	--	--	--	--	--	--
%RSD	.0763480	--	--	--	--	--	--
#1	33302	--	--	--	--	--	--
#2	33266	--	--	--	--	--	--

Method: TRACE Sample Name: qc 21+7
Run Time: 09/29/98 06:42:34
Comment:
Mode: CONC Corr. Factor: 1

Operator:

Elem	Ag3280	Al2373	As1890	B_2496	Ba4934	Be3130	Ca3179
Units	ppb	ppm	ppb	ppb	ppb	ppb	ppm
Avge	506.6	.4912	532.5	543.5	487.3	527.4	.4920
SDev	.2	.0057	.5	3.1	.1	.1	.0032
%RSD	.0320	1.154	.0974	.5632	.0162	.0104	.6497

#1	506.7	.4952	532.9	541.4	487.3	527.4	.4942
#2	506.4	.4872	532.1	545.7	487.2	527.3	.4897

Elem	Cd2265	Co2286	Cr2677	Cu3247	FE	Mg2790	Mn2576
Units	ppb	ppb	ppb	ppb	ppm	ppm	ppb
Avge	522.0	512.6	501.1	481.6	.5125	.4885	510.1
SDev	.1	1.0	.3	.1	.0010	.0012	.1
%RSD	.0265	.1926	.0566	.0166	.1880	.2384	.0121

#1	522.1	513.3	501.3	481.6	.5131	.4893	510.1
#2	521.9	511.9	500.9	481.5	.5118	.4877	510.2

Elem	Na	Ni2316	2203/1	2203/2	Se1960	Pb2203	Sb2068
Units	ppm	ppb	ppb	ppb	ppb	ppb	ppb
Avge	.5279	513.0	516.2	505.0	534.7	508.7	511.6
SDev	.0005	.2	4.5	4.6	1.4	1.5	2.7
%RSD	.0871	.0407	.8781	.9059	.2694	.3031	.5232

500019

#1	.5283	512.9	519.4	501.7	533.6	507.6	509.7
#2	.5276	513.2	513.0	508.2	535.7	509.8	513.5
Elem	1960/1	1960/2	Tl1908	V_2924	Zn2138		
Units	ppb	ppb	ppb	ppb	ppb		
Avge	539.1	532.5	492.7	497.3	514.6		
SDev	7.2	5.7	1.4	.9	.1		
%RSD	1.330	1.078	.2795	.1776	.0188		
#1	544.1	528.4	493.7	496.6	514.6		
#2	534.0	536.5	491.7	497.9	514.5		
IntStd	1	2	3	4	5	6	7
Mode	Counts	NOTUSED	NOTUSED	NOTUSED	NOTUSED	NOTUSED	NOTUSED
Elem	Y	--	--	--	--	--	--
Wavlen	371.030	--	--	--	--	--	--
Avge	32792	--	--	--	--	--	--
SDev	2.640602	--	--	--	--	--	--
%RSD	.0080527	--	--	--	--	--	--
#1	32790	--	--	--	--	--	--
#2	32793	--	--	--	--	--	--

Method: TRACE Sample Name: blank
 Run Time: 09/29/98 06:47:54
 Comment:
 Mode: CONC Corr. Factor: 1

Operator:

Restd

Elem	Ag3280	Al2373	As1890	B_2496	Ba4934	Be3130	Ca3179
Units	ppb	ppm	ppb	ppb	ppb	ppb	ppm
Avge	1.156	.0006	-1.570	15.55	.2283	.1318	.0004
SDev	.258	.0027	.539	.60	.1483	.0869	.0004
%RSD	22.29	421.4	34.34	3.860	64.94	65.91	83.44
#1	1.338	.0026	-1.951	15.97	.3331	.1933	.0007
#2	.9736	-.0013	-1.189	15.12	.1235	.0704	.0002
Elem	Cd2265	Co2286	Cr2677	Cu3247	FE	Mg2790	Mn2576
Units	ppb	ppb	ppb	ppb	ppm	ppm	ppb
Avge	.2674	.2394	.2550	1.509	.0014	.0055	.1848
SDev	.1024	.2856	.0748	.421	.0007	.0027	.0000
%RSD	38.30	119.3	29.31	27.92	47.84	49.60	.0241
#1	.3399	.4413	.3079	1.806	.0019	.0036	.1848
#2	.1950	.0375	.2022	1.211	.0009	.0074	.1849
Elem	Na	Ni2316	2203/1	2203/2	Se1960	Pb2283	Sb2068
Units	ppm	ppb	ppb	ppb	ppb	ppb	ppb
Avge	.0104	.2826	-1.827	1.976	.0168	.7098	3.209
SDev	.0011	.3335	.052	.813	.5065	.5245	2.311
%RSD	11.02	118.0	2.869	41.12	3022.	73.90	72.01
#1	.0112	.5184	-1.864	2.550	.3749	1.081	4.843
#2	.0096	.0468	-1.790	1.401	-.3414	.3389	1.575

500020

Mode	Counts	NOTUSED	NOTUSED	NOTUSED	NOTUSED	NOTUSED	NOTUSED
Elem	Y	--	--	--	--	--	--
Wavlen	371.030	--	--	--	--	--	--
Avge	34484	--	--	--	--	--	--
SDev	139.0708	--	--	--	--	--	--
%RSD	.4032854	--	--	--	--	--	--
#1	34386	--	--	--	--	--	--
#2	34583	--	--	--	--	--	--

Method: TRACE

Slope = Conc(SIR)/IR

Element	Wavlen	High std	Low std	Slope	Y-intercept	Date Standardized
Ag3280	328.068	X-NLS 3	STD1-Blank	321.160	3.60887	09/29/98 07:08:14
Al2373	237.313	INT A-1	STD1-Blank	5.32675	.006561	09/29/98 07:08:14
As1890	189.042	X-NLS 3	STD1-Blank	830.543	1.88198	09/29/98 07:08:14
B_2496	249.678	X-NLS 3	STD1-Blank	335.074	-9.60946	09/29/98 07:08:14
Ba4934	493.409	X-NLS 3	STD1-Blank	43.8500	-.021639	09/29/98 07:08:14
Be3130	313.042	X-NLS 3	STD1-Blank	31.6164	.533109	09/29/98 07:08:14
Ca3179	317.933	INT A-1	STD1-Blank	9.74709	-.052432	09/29/98 07:08:14
Cd2265	226.502	X-NLS 3	STD1-Blank	41.5740	.121030	09/29/98 07:08:14
Co2286	228.616	X-NLS 3	STD1-Blank	402.418	.652602	09/29/98 07:08:14
Cr2677	267.716	X-NLS 3	STD1-Blank	148.672	-.257069	09/29/98 07:08:14
Cu3247	324.753	X-NLS 3	STD1-Blank	470.041	-10.1542	09/29/98 07:08:14
FE	271.441	ODD-H	STD1-Blank	7.73424	-.003470	09/29/98 07:08:14
FE	259.940	X-NLS 3	STD1-Blank	.778698	-.001130	09/29/98 07:08:14
Mg2790	279.078	INT A-1	STD1-Blank	7.45670	-.003243	09/29/98 07:08:14
Mn2576	257.610	X-NLS 3	STD1-Blank	594.760	-.008648	09/29/98 07:08:14
Na	588.995	ODD-L	STD1-Blank	.419009	-.046689	09/29/98 07:08:14
Na	330.223	ODD-H	STD1-Blank	1.23171	.000630	09/29/98 07:08:14
Ni2316	231.604	X-NLS 3	STD1-Blank	173.076	.772870	09/29/98 07:08:14
2203/1	220.351	X-NLS 3	STD1-Blank	134.708	-1.43434	09/29/98 07:08:14
2203/2	220.352	X-NLS 3	STD1-Blank	194.281	-.603021	09/29/98 07:08:14
Se1960	196.026	NONE	NONE	1.00000	.000000	*09/29/98 07:08:14
Pb2203	220.353	NONE	NONE	1.00000	.000000	*09/29/98 07:08:14
Sb2068	206.838	X-NLS 3	STD1-Blank	380.758	-3.85528	09/29/98 07:08:14
1960/1	196.021	X-NLS 3	STD1-Blank	635.936	11.8872	09/29/98 07:08:14
1960/2	196.022	X-NLS 3	STD1-Blank	611.870	-7.87281	09/29/98 07:08:14
Tl1908	190.864	X-NLS 3	STD1-Blank	872.212	7.63686	09/29/98 07:08:14
V_2924	292.402	X-NLS 3	STD1-Blank	2518.71	1.49721	09/29/98 07:08:14
Zn2138	213.856	X-NLS 3	STD1-Blank	235.187	-.184221	09/29/98 07:08:14

Method: TRACE

Sample Name: blank

Operator: SMH

Run Time: 09/29/98 07:31:37

Comment:

Mode: CONC Corr. Factor: 1

Elem	Ag3280	Al2373	As1890	Ba4934	Cd2265	Cr2677	FE
Units	ppb	ppm	ppb	ppb	ppb	ppb	ppm
Avge	.4051	.0180	.9373	.0518	.0904	-.0684	.0018
SDev	.0934	.0042	3.307	.0116	.0495	.1857	.0009
%RSD	23.06	23.02	352.9	22.36	54.78	271.4	49.70
#1	.3390	.0210	3.276	.0600	.1254	-.1997	.0025
#2	.4711	.0151	-1.401	.0436	.0554	.0629	.0012

500021

Elem	Mn2576	2203/1	2203/2	Pb2203	V_2924
Units	ppb	ppb	ppb	ppb	ppb
Avge	.0839	.1620	.2130	.1962	.1989
SDev	.1063	.9267	1.611	.7662	.1733
%RSD	126.8	572.0	756.6	390.5	87.16

#1	.1590	.8173	-.9265	-.3456	.0763
#2	.0087	-.4933	1.352	.7380	.3214

IntStd	1	2	3	4	5	6	7
Mode	Counts	NOTUSED	NOTUSED	NOTUSED	NOTUSED	NOTUSED	NOTUSED
Elem	Y	--	--	--	--	--	--
Wavlen	371.030	--	--	--	--	--	--
Avge	34865	--	--	--	--	--	--
SDev	833.7203	--	--	--	--	--	--
%RSD	2.391297	--	--	--	--	--	--

#1	35454	--	--	--	--	--
#2	34275	--	--	--	--	--

Method: TRACE Sample Name: ics

Run Time: 09/29/98 07:36:38

Operator: SMH

Comment:

Mode: CONC Corr. Factor: 1

Elem	Ag3280	Al2373	As1890	Ba4934	Cd2265	Cr2677	FE
Units	ppb	ppm	ppb	ppb	ppb	ppb	ppm
Avge	540.1	514.2	562.1	498.0	492.2	458.7	196.3
SDev	.6	.2	2.3	.1	.6	.9	.0
%RSD	1.068	.0333	.4158	.0205	.1234	.1959	.0089

#1	540.5	514.4	560.5	497.9	492.6	458.0	196.3
#2	539.7	514.1	563.8	498.1	491.7	459.3	196.3

Elem	Mn2576	2203/1	2203/2	Pb2203	V_2924
Units	ppb	ppb	ppb	ppb	ppb
Avge	508.6	753.0	350.8	484.7	506.3
SDev	.1	2.6	.7	.4	.7
%RSD	.0261	.3399	.2098	.0746	.1391

#1	508.5	754.8	350.3	485.0	505.8
#2	508.7	751.2	351.3	484.5	506.8

IntStd	1	2	3	4	5	6	7
Mode	Counts	NOTUSED	NOTUSED	NOTUSED	NOTUSED	NOTUSED	NOTUSED
Elem	Y	--	--	--	--	--	--
Wavlen	371.030	--	--	--	--	--	--
Avge	26994	--	--	--	--	--	--
SDev	140.3911	--	--	--	--	--	--
%RSD	.5200796	--	--	--	--	--	--

#1	26895	--	--	--	--	--
#2	27093	--	--	--	--	--

500022

#2	3.311	1.604	1.041	1.229	1.103		
IntStd	1	2	3	4	5	6	7
Mode	Counts	NOTUSED	NOTUSED	NOTUSED	NOTUSED	NOTUSED	NOTUSED
Elem	Y	--	--	--	--	--	--
Wavlen	371.030	--	--	--	--	--	--
Avge	28594	--	--	--	--	--	--
SDev	114.4629	--	--	--	--	--	--
%RSD	.4002989	--	--	--	--	--	--
#1	28513	--	--	--	--	--	--
#2	28675	--	--	--	--	--	--

Method: TRACE Sample Name: BATCH 77 BLANK Operator: SMH
Run Time: 09/29/98 07:51:39
Comment:
Mode: CONC Corr. Factor: 1

Elem	Ag3280	Al2373	As1890	Ba4934	Cd2265	Cr2677	FE
Units	ppb	ppm	ppb	ppb	ppb	ppb	ppm
Avge	.6621	.0045	2.758	-.0353	-.1091	-.0574	.0024
SDev	.3733	.0039	.569	.0214	.0343	.6823	.0004
%RSD	56.38	86.17	20.64	60.71	31.42	1188.	18.62

#1	.9260	.0073	2.355	-.0504	-.1334	.4250	.0027
#2	.3981	.0018	3.160	-.0201	-.0849	-.5399	.0021

Elem	Mn2576	2203/1	2203/2	Pb2203	V_2924
Units	ppb	ppb	ppb	ppb	ppb
Avge	.2174	3.068	-.9782	.3694	-.1563
SDev	.1166	1.209	1.2146	.4076	.1253
%RSD	53.61	39.39	124.2	110.3	80.16

#1	.1350	3.923	-1.837	.0812	-.0677
#2	.2998	2.213	-.1194	.6577	-.2449

IntStd	1	2	3	4	5	6	7
Mode	Counts	NOTUSED	NOTUSED	NOTUSED	NOTUSED	NOTUSED	NOTUSED
Elem	Y	--	--	--	--	--	--
Wavlen	371.030	--	--	--	--	--	--
Avge	28944	--	--	--	--	--	--
SDev	39.69466	--	--	--	--	--	--
%RSD	.1371414	--	--	--	--	--	--

#1	28972	--	--	--	--	--	--
#2	28916	--	--	--	--	--	--

Method: TRACE Sample Name: 238168 100X Operator: SMH
Run Time: 09/29/98 07:56:40
Comment:
Mode: CONC Corr. Factor: 1

Elem	Ag3280	Al2373	As1890	Ba4934	Cd2265	Cr2677	FE
Units	ppb	ppm	ppb	ppb	ppb	ppb	ppm
Avge	.2210	.0070	4.610	.1066	.2141	.0256	.0076

500023

SDev	.0989	.0006	.834	.0522	.1168	.1374	.0000
%RSD	44.78	9.314	18.09	48.92	54.56	536.0	.4171
#1	.2909	.0066	4.020	.1435	.2966	.1228	.0076
#2	.1510	.0075	5.200	.0697	.1315	-.0715	.0076
Elem	Mn2576	2203/1	2203/2	Pb2203	V_2924		
Units	ppb	ppb	ppb	ppb	ppb		
Avge	.2694	1.356	-.8247	-.0983	.1008		
SDev	.0427	.577	.4561	.1120	.0051		
%RSD	15.85	42.56	55.30	113.9	5.063		
#1	.2996	1.764	-1.147	-.1776	.1044		
#2	.2392	.9478	-.5022	-.0191	.0972		
IntStd	1	2	3	4	5	6	7
Mode	Counts	NOTUSED	NOTUSED	NOTUSED	NOTUSED	NOTUSED	NOTUSED
Elem	Y	--	--	--	--	--	--
Wavlen	371.030	--	--	--	--	--	--
Avge	28864	--	--	--	--	--	--
SDev	105.4583	--	--	--	--	--	--
%RSD	.3653602	--	--	--	--	--	--
#1	28939	--	--	--	--	--	--
#2	28790	--	--	--	--	--	--

Method: TRACE Sample Name: 238168 100X SPK Operator: SMH
Run Time: 09/29/98 08:01:40
Comment:
Mode: CONC Corr. Factor: 1

Elem	Ag3280	Al2373	As1890	Ba4934	Cd2265	Cr2677	FE
Units	ppb (100.1%)	ppm	ppb (113 C)	ppb (103.6%)	ppb (110.1)	ppb (106.0%)	ppm
Avge	100.3	1.030	117.6	103.7	110.3	106.0	1.068
SDev	1.6	.004	.0	.0	.2	.2	.001
%RSD	1.546	.3534	.0124	.0043	.1846	.2253	.0741
#1	101.4	1.033	117.6	103.7	110.1	105.8	1.068
#2	99.24	1.028	117.6	103.7	110.4	106.2	1.067

Elem	Mn2576	2203/1	2203/2	Pb2203	V_2924
Units	ppb	ppb	ppb	ppb (108.1%)	ppb
Avge	107.7	110.9	106.7	108.1	105.2
SDev	.2	.2	.1	.1	.5
%RSD	.1557	.2230	.0859	.1327	.4633
#1	107.6	111.1	106.8	108.2	104.8
#2	107.8	110.8	106.6	108.0	105.5

IntStd	1	2	3	4	5	6	7
Mode	Counts	NOTUSED	NOTUSED	NOTUSED	NOTUSED	NOTUSED	NOTUSED
Elem	Y	--	--	--	--	--	--
Wavlen	371.030	--	--	--	--	--	--
Avge	30306	--	--	--	--	--	--
SDev	39.36458	--	--	--	--	--	--

500024

%RSD	.1298915	--	--	--	--	--	--
#1	30334	--	--	--	--	--	--
#2	30278	--	--	--	--	--	--

Method: TRACE Sample Name: 238168 100X SPK DUP Operator: SMH
Run Time: 09/29/98 08:06:40
Comment:
Mode: CONC Corr. Factor: 1

Elem	Ag3280	Al2373	As1890	Ba4934	Cd2265	Cr2677	FE
Units	ppb	ppm	ppb	ppb	ppb	ppb	ppm
Avge	100.2	1.028	117.5	103.7	110.3	106.4	1.066
SDev	1.7	.001	.8	.1	.1	.6	.000
%RSD	1.729	.0686	.7062	.1107	.0516	.5645	.0127

#1	101.5	1.027	116.9	103.6	110.4	106.0	1.066
#2	99.01	1.028	118.1	103.8	110.3	106.8	1.066

Elem	Mn2576	2203/1	2203/2	Pb2203	V_2924
Units	ppb	ppb	ppb	ppb	ppb
Avge	107.6	111.5	107.2	108.6	105.5
SDev	.1	.2	.0	.1	.3
%RSD	.0751	.1944	.0334	.0884	.3002

#1	107.5	111.7	107.2	108.7	105.7
#2	107.6	111.4	107.2	108.6	105.2

IntStd	1	2	3	4	5	6	7
Mode	Counts	NOTUSED	NOTUSED	NOTUSED	NOTUSED	NOTUSED	NOTUSED
Elem	Y	--	--	--	--	--	--
Wavlen	371.030	--	--	--	--	--	--
Avge	30260	--	--	--	--	--	--
SDev	75.00442	--	--	--	--	--	--
%RSD	.2478643	--	--	--	--	--	--

#1	30207	--	--	--	--	--	--
#2	30313	--	--	--	--	--	--

Method: TRACE Sample Name: 238168 100X DIG. SPK Operator: SMH
Run Time: 09/29/98 08:11:40
Comment:
Mode: CONC Corr. Factor: 1

Elem	Ag3280	Al2373	As1890	Ba4934	Cd2265	Cr2677	FE
Units	ppb	ppm	ppb	ppb	ppb	ppb	ppm
Avge	.2078	.0071	115.6	.1265	.0487	.2065	.0076
SDev	.5516	.0000	.8	.0738	.2421	.4971	.0001
%RSD	265.5	.0572	.7212	58.39	497.2	240.8	1.594

#1	.5978	.0071	116.2	.1787	.2199	-.1451	.0075
#2	-.1823	.0071	115.0	.0743	-.1225	.5580	.0077

Elem	Mn2576	2203/1	2203/2	Pb2203	V_2924
Units	ppb	ppb	ppb	ppb	ppb

500025

Avge	.1962	1.760	-1.046	-.1112	-.0262
SDev	.1438	.132	.149	.1431	.3187
%RSD	73.29	7.506	14.20	128.6	1217.

#1	.2978	1.666	-1.151	-.2124	.1992
#2	.0945	1.853	-.9406	-.0100	-.2516

IntStd	1	2	3	4	5	6	7
Mode	Counts	NOTUSED	NOTUSED	NOTUSED	NOTUSED	NOTUSED	NOTUSED
Elem	Y	--	--	--	--	--	--
Wavlen	371.030	--	--	--	--	--	--
Avge	28961	--	--	--	--	--	--
SDev	213.6512	--	--	--	--	--	--
%RSD	.7377260	--	--	--	--	--	--

#1	29112	--	--	--	--	--	--
#2	28810	--	--	--	--	--	--

Method: TRACE Sample Name: 238168 100X DIG. S Operator: SMH
Run Time: 09/29/98 08:16:40
Comment:
Mode: CONC Corr. Factor: 1

Elem	Ag3280	Al2373	As1890	Ba4934	Cd2265	Cr2677	FE
Units	ppb	ppm	ppb	ppb	ppb	ppb	ppm
Avge	.8644	.0048	113.9	.2633	.1459	.0500	.0074
SDev	.4286	.0012	1.9	.0451	.0674	.2445	.0000
%RSD	49.58	24.55	1.631	17.13	46.18	488.7	.1914

#1	.5614	.0040	115.2	.2314	.0983	-.1228	.0074
#2	1.167	.0056	112.6	.2952	.1936	.2229	.0074

Elem	Mn2576	2203/1	2203/2	Pb2203	V_2924
Units	ppb	ppb	ppb	ppb	ppb
Avge	.2290	-.2709	.3216	.1245	.2716
SDev	.1314	.0303	.5638	.3861	.2482
%RSD	57.39	11.18	175.3	310.1	91.40

#1	.1361	-.2495	.7203	.3976	.0961
#2	.3219	-.2924	-.0771	-.1485	.4471

IntStd	1	2	3	4	5	6	7
Mode	Counts	NOTUSED	NOTUSED	NOTUSED	NOTUSED	NOTUSED	NOTUSED
Elem	Y	--	--	--	--	--	--
Wavlen	371.030	--	--	--	--	--	--
Avge	28778	--	--	--	--	--	--
SDev	16.02867	--	--	--	--	--	--
%RSD	.0556972	--	--	--	--	--	--

#1	28767	--	--	--	--	--	--
#2	28790	--	--	--	--	--	--

Method: TRACE Sample Name: 239496 100X S.D. Operator: SMH
Run Time: 09/29/98 08:21:40

500026

#2 30166 -- -- -- -- --

Method: TRACE Sample Name: 239809 10X Operator: SMH
Run Time: 09/29/98 08:46:44
Comment:
Mode: CONC Corr. Factor: 1

Elem	Ag3280	Al2373	As1890	Ba4934	Cd2265	Cr2677	FE
Units	ppb (9.712)	ppm	ppb	ppb (126.3)	ppb (4.623)	ppb (46.73)	ppm
Avge	.9212	1.081	43760.	12.63	.3051	4.623	2.876
SDev	.5428	.001	178.	.01	.0245	.433	.005
%RSD	58.92	.0586	.4060	.0448	8.020	9.367	.1713

#1	1.305	1.081	43880.	12.64	.2878	4.929	2.879
#2	.5374	1.082	43630.	12.63	.3224	4.317	2.872

Elem	Mn2576	2203/1	2203/2	Pb2203	V_2924
Units	ppb	ppb	ppb	ppb (45.43)	ppb
Avge	147.1	4.489	4.576	4.547	9.290
SDev	.4	.274	.273	.273	.478
%RSD	.2441	6.106	5.964	6.010	5.148

#1	147.4	4.683	4.769	4.741	9.628
#2	146.9	4.295	4.383	4.354	8.952

IntStd	1	2	3	4	5	6	7
Mode	Counts	NOTUSED	NOTUSED	NOTUSED	NOTUSED	NOTUSED	NOTUSED
Elem	Y	--	--	--	--	--	--
Wavlen	371.030	--	--	--	--	--	--
Avge	31621	--	--	--	--	--	--
SDev	563.0255	--	--	--	--	--	--
%RSD	1.780557	--	--	--	--	--	--

#1	31223	--	--	--	--	--	--
#2	32019	--	--	--	--	--	--

Method: TRACE Sample Name: 239809 10X SPK Operator: SMH
Run Time: 09/29/98 08:51:45
Comment:
Mode: CONC Corr. Factor: 1

Elem	Ag3280	Al2373	As1890	Ba4934	Cd2265	Cr2677	FE
Units	ppb (106.6)	ppm	ppb (130.6)	ppb (103.6)	ppb (106.6)	ppb (105.5)	ppm
Avge	106.7	2.120	43890.	116.2	108.9	110.1	3.918
SDev	.2	.000	28.	.1	.0	.1	.003
%RSD	.1795	.0039	.0629	.0736	.0412	.1056	.0707

#1	106.5	2.120	43910.	116.1	108.9	110.2	3.920
#2	106.8	2.120	43870.	116.2	108.8	110.0	3.916

Elem	Mn2576	2203/1	2203/2	Pb2203	V_2924
Units	ppb	ppb	ppb	ppb (100.3)	ppb
Avge	253.0	116.3	111.1	112.8	115.4
SDev	.1	.9	1.4	.7	.5
%RSD	.0461	.7676	1.302	.5914	.4360

500027

Units	ppb	ppm	ppb	ppb	ppb	ppb	ppm
Avge	61.24	2.157	44780.	110.1	104.4	105.4	3.954
SDev	.37	.005	17.	.1	.1	.5	.001
%RSD	.6084	.2127	.0377	.0785	.0528	.4769	.0140

#1	61.47	2.154	44790.	110.0	104.4	105.0	3.955
#2	60.95	2.160	44770.	110.2	104.4	105.7	3.954

Elem	Mn2576	2203/1	2203/2	Pb2203	V_2924
Units	ppb	ppb	ppb	ppb	ppb
Avge	251.6	111.0	104.1	106.4	110.3
SDev	.0	1.7	1.7	.6	.4
%RSD	.0068	1.547	1.664	.5479	.3485

#1	251.5	112.3	102.8	106.0	110.6
#2	251.6	109.8	105.3	106.8	110.1

IntStd	1	2	3	4	5	6	7
Mode	Counts	NOTUSED	NOTUSED	NOTUSED	NOTUSED	NOTUSED	NOTUSED
Elem	Y	--	--	--	--	--	--
Wavlen	371.030	--	--	--	--	--	--
Avge	31355	--	--	--	--	--	--
SDev	290.4469	--	--	--	--	--	--
%RSD	.9263096	--	--	--	--	--	--

#1	31150	--	--	--	--	--	--
#2	31561	--	--	--	--	--	--

Method: TRACE Sample Name: 239809 10X DIG. SD Operator: SMH
Run Time: 09/29/98 09:06:47
Comment:
Mode: CONC Corr. Factor: 1

Elem	Ag3280	Al2373	As1890	Ba4934	Cd2265	Cr2677	FE
Units	ppb	ppm	ppb	ppb	ppb	ppb	ppm
Avge	71.34	2.192	45720.	112.1	106.1	106.5	4.033
SDev	.25	.002	90.	.0	.2	.3	.007
%RSD	.3451	.0943	.1974	.0077	.1869	.3230	.1624

#1	71.51	2.190	45780.	112.1	106.2	106.7	4.038
#2	71.16	2.193	45650.	112.1	105.9	106.2	4.029

Elem	Mn2576	2203/1	2203/2	Pb2203	V_2924
Units	ppb	ppb	ppb	ppb	ppb
Avge	256.1	109.0	107.4	107.9	112.5
SDev	.4	.2	1.0	.8	.2
%RSD	.1730	.2241	.9565	.7102	.1614

#1	256.4	109.1	108.1	108.5	112.7
#2	255.8	108.8	106.7	107.4	112.4

IntStd	1	2	3	4	5	6	7
Mode	Counts	NOTUSED	NOTUSED	NOTUSED	NOTUSED	NOTUSED	NOTUSED
Elem	Y	--	--	--	--	--	--
Wavlen	371.030	--	--	--	--	--	--

500028

Avge	31505	--	--	--	--	--	--
SDev	259.8037	--	--	--	--	--	--
%RSD	.8246374	--	--	--	--	--	--
#1	31322	--	--	--	--	--	--
#2	31689	--	--	--	--	--	--

Method: TRACE Sample Name: 239810 10X Operator: SMH
Run Time: 09/29/98 09:11:47
Comment:
Mode: CONC Corr. Factor: 1

Elem	Ag3280	Al2373	As1890	Ba4934	Cd2265	Cr2677	FE
Units	ppb (LMDL)	ppm	ppb (706)	ppb (163.4)	ppb (LMDL)	ppb (5.61)	ppm
Avge	.3236	.0453	706.1	16.34	.1045	.5016	2.128
SDev	.1869	.0075	6.6	.02	.0082	.1440	.002
%RSD	57.74	16.64	.9316	.0927	7.870	28.70	.0891
#1	.4558	.0506	710.7	16.35	.1104	.6034	2.129
#2	.1915	.0399	701.4	16.33	.0987	.3998	2.127

Elem	Mn2576	2203/1	2203/2	Pb2203	V_2924
Units	ppb	ppb	ppb	ppb (38.53)	ppb
Avge	90.27	3.981	3.789	3.853	1.656
SDev	.04	1.808	.352	.837	.218
%RSD	.0446	45.41	9.282	21.71	13.19
#1	90.30	5.260	4.038	4.445	1.811
#2	90.24	2.703	3.540	3.262	1.502

IntStd	1	2	3	4	5	6	7
Mode	Counts	NOTUSED	NOTUSED	NOTUSED	NOTUSED	NOTUSED	NOTUSED
Elem	Y	--	--	--	--	--	--
Wavlen	371.030	--	--	--	--	--	--
Avge	32766	--	--	--	--	--	--
SDev	149.7243	--	--	--	--	--	--
%RSD	.4569460	--	--	--	--	--	--
#1	32660	--	--	--	--	--	--
#2	32872	--	--	--	--	--	--

Method: TRACE Sample Name: 239811 10X Operator: SMH
Run Time: 09/29/98 09:16:47
Comment:
Mode: CONC Corr. Factor: 1

Elem	Ag3280	Al2373	As1890	Ba4934	Cd2265	Cr2677	FE
Units	ppb (LMDL)	ppm	ppb (250.5)	ppb (LMDL)	ppb (LMDL)	ppb (LMDL)	ppm
Avge	.3466	.0185	25.05	1.330	.0258	.6312	.4557
SDev	.1031	.0016	.02	.021	.1352	.0832	.0010
%RSD	29.74	8.707	.0811	1.569	524.4	13.18	.2246
#1	.2738	.0173	25.06	1.315	-.0698	-.6900	.4550
#2	.4195	.0196	25.03	1.344	.1214	-.5723	.4564

Elem	Mn2576	2203/1	2203/2	Pb2203	V_2924
Units	ppb	ppb	ppb	ppb	ppb
Avge	48.32	-1.511	.5288	-.1503	.1890
SDev	.01	.476	.4270	.1263	.1439
%RSD	.0277	31.48	80.73	84.03	76.13

#1	48.33	-1.175	.2269	-.2397	.0873
#2	48.31	-1.848	.8307	-.0610	.2908

IntStd	1	2	3	4	5	6	7
Mode	Counts	NOTUSED	NOTUSED	NOTUSED	NOTUSED	NOTUSED	NOTUSED
Elem	Y	--	--	--	--	--	--
Wavlen	371.030	--	--	--	--	--	--
Avge	36037	--	--	--	--	--	--
SDev	120.5424	--	--	--	--	--	--
%RSD	.3344933	--	--	--	--	--	--

#1	36123	--	--	--	--	--	--
#2	35952	--	--	--	--	--	--

Method: TRACE Sample Name: 240054 10X

Operator: SMH

Run Time: 09/29/98 09:21:48

Comment:

Mode: CONC Corr. Factor: 1

Elem	Ag3280	Al2373	As1890	Ba4934	Cd2265	Cr2677	FE
Units	ppb	ppm	ppb	ppb	ppb	ppb	ppm
Avge	.8696	1.381	17950.	14.02	.3261	2.518	2.950
SDev	.4758	.001	14.	.01	.0174	.258	.004
%RSD	54.72	.0787	.0800	.0925	5.347	10.23	.1337

#1	.5332	1.382	17960.	14.01	.3385	2.700	2.953
#2	1.206	1.380	17940.	14.03	.3138	2.336	2.948

Elem	Mn2576	2203/1	2203/2	Pb2203	V_2924
Units	ppb	ppb	ppb	ppb	ppb
Avge	115.8	2.346	.3062	.9858	4.869
SDev	.1	.762	.2278	.4057	.149
%RSD	.0661	32.48	74.37	41.16	3.054

#1	115.8	1.807	.1452	.6989	4.975
#2	115.7	2.885	.4673	1.273	4.764

IntStd	1	2	3	4	5	6	7
Mode	Counts	NOTUSED	NOTUSED	NOTUSED	NOTUSED	NOTUSED	NOTUSED
Elem	Y	--	--	--	--	--	--
Wavlen	371.030	--	--	--	--	--	--
Avge	32652	--	--	--	--	--	--
SDev	373.8413	--	--	--	--	--	--
%RSD	1.144920	--	--	--	--	--	--

#1	32388	--	--	--	--	--	--
#2	32917	--	--	--	--	--	--

500030

Method: TRACE Sample Name: qc 21+7

Operator: SMH

Run Time: 09/29/98 09:26:48

Comment:

Mode: CONC Corr. Factor: 1

Elem	Ag3280	Al2373	As1890	Ba4934	Cd2265	Cr2677	FE
Units	ppb	ppm	ppb	ppb	ppb	ppb	ppm
Avge	505.8	.4857	532.1	484.0	520.1	494.7	.5065
SDev	.1	.0060	4.9	.0	.5	.0	.0010
%RSD	.0245	1.237	91.66	0090	.0865	.0081	.1900
#1	505.9	.4900	535.5	484.0	520.5	494.7	.5058
#2	505.7	.4815	528.6	483.9	519.8	494.8	.5072
Elem	Mn2576	2203/1	2203/2	Pb2203	V_2924		
Units	ppb	ppb	ppb	ppb	ppb		
Avge	506.4	508.5	503.0	504.8	493.7		
SDev	.1	4.0	.6	1.7	1.4		
%RSD	.0202	.7823	.1260	.3461	.2867		
#1	506.4	511.3	503.5	506.1	492.7		
#2	506.3	505.7	502.6	503.6	494.7		
IntStd	1	2	3	4	5	6	7
Mode	Counts	NOTUSED	NOTUSED	NOTUSED	NOTUSED	NOTUSED	NOTUSED
Elem	Y	--	--	--	--	--	--
Wavlen	371.030	--	--	--	--	--	--
Avge	35000	--	--	--	--	--	--
SDev	69.39314	--	--	--	--	--	--
%RSD	.1982649	--	--	--	--	--	--
#1	34951	--	--	--	--	--	--
#2	35049	--	--	--	--	--	--

Method: TRACE Sample Name: blank

Operator: SMH

Run Time: 09/29/98 09:31:48

Comment:

Mode: CONC Corr. Factor: 1

Elem	Ag3280	Al2373	As1890	Ba4934	Cd2265	Cr2677	FE
Units	ppb	ppm	ppb	ppb	ppb	ppb	ppm
Avge	-.4087	.0021	4.880	.0849	.1701	.0408	.0005
SDev	1.0342	.0016	1.124	.0353	.0793	.0052	.0003
%RSD	253.1	77.18	23.03	41.53	46.60	12.61	49.78
#1	-1.140	.0009	4.085	.0600	.1141	.0445	.0003
#2	.3226	.0032	5.675	.1099	.2262	.0372	.0007
Elem	Mn2576	2203/1	2203/2	Pb2203	V_2924		
Units	ppb	ppb	ppb	ppb	ppb		
Avge	.2213	.9725	-.8312	-.2304	-.2107		
SDev	.0450	.8263	.8036	.2609	.5534		
%RSD	20.33	84.96	96.67	113.2	262.6		
#1	.1895	.3883	-.2630	-.0459	-.6020		
#2	.2532	1.557	-1.399	-.4148	.1806		

500031

IntStd	1	2	3	4	5	6	7
Mode	Counts	NOTUSED	NOTUSED	NOTUSED	NOTUSED	NOTUSED	NOTUSED
Elem	Y	--	--	--	--	--	--
Wavlen	371.030	--	--	--	--	--	--
Avge	36172	--	--	--	--	--	--
SDev	248.9596	--	--	--	--	--	--
%RSD	.6882678	--	--	--	--	--	--
#1	35996	--	--	--	--	--	--
#2	36348	--	--	--	--	--	--

Method: TRACE Sample Name: 240190 10X Operator: SMH
Run Time: 09/29/98 09:36:49
Comment:
Mode: CONC Corr. Factor: 1

Elem	Ag3280	Al2373	As1890	Ba4934	Cd2265	Cr2677	FE
Units	ppb (80.25)	ppm	ppb (167100)	ppb (192.1)	ppb (5.340)	ppb (38.08)	ppm
Avge	8.025	.3888	16710.	19.21	.5340	3.808	1.682
SDev	.238	.0046	8.	.01	.0093	.288	.003
%RSD	2.960	1.169	.0483	.0774	1.746	7.562	.1779

#1	8.192	.3920	16710.	19.22	.5274	4.012	1.684
#2	7.857	.3856	16700.	19.19	.5406	3.604	1.679

Elem	Mn2576	2203/1	2203/2	Pb2203	V_2924
Units	ppb	ppb	ppb	ppb (174.1)	ppb
Avge	81.45	17.97	17.13	17.41	7.528
SDev	.17	.95	1.02	.37	.109
%RSD	.2057	5.271	5.960	2.100	1.450

#1	81.57	18.64	16.41	17.15	7.605
#2	81.33	17.30	17.85	17.67	7.451

IntStd	1	2	3	4	5	6	7
Mode	Counts	NOTUSED	NOTUSED	NOTUSED	NOTUSED	NOTUSED	NOTUSED
Elem	Y	--	--	--	--	--	--
Wavlen	371.030	--	--	--	--	--	--
Avge	32069	--	--	--	--	--	--
SDev	282.8096	--	--	--	--	--	--
%RSD	.8818920	--	--	--	--	--	--

#1	31869	--	--	--	--	--	--
#2	32268	--	--	--	--	--	--

Method: TRACE Sample Name: 240190 10X SPK Operator: SMH
Run Time: 09/29/98 09:41:49
Comment:
Mode: CONC Corr. Factor: 1

Elem	Ag3280	Al2373	As1890	Ba4934	Cd2265	Cr2677	FE
Units	ppb (106.2)	ppm	ppb (16930)	ppb (123.2)	ppb (109.0)	ppb (109.7)	ppm
Avge	106.2	1.423	16930.	123.2	109.0	109.7	2.734
SDev	.0	.001	5.	.0	.0	.1	.000
%RSD	.0292	.0798	.0296	.0063	.0183	.0548	.0066

500032

#1	106.3	1.422	16930.	123.2	109.0	109.7	2.734
#2	106.2	1.424	16930.	123.2	109.0	109.7	2.734

Elem	Mn2576	2203/1	2203/2	Pb2203	V_2924
Units	ppb	ppb	ppb	ppb	ppb
Avge	187.8	125.4	123.4	124.0	113.5
SDev	.1	2.5	.3	1.1	.4
%RSD	.0311	2.021	.2766	.8638	.3787

#1	187.8	127.2	123.6	124.8	113.8
#2	187.8	123.6	123.1	123.3	113.2

IntStd	1	2	3	4	5	6	7
Mode	Counts	NOTUSED	NOTUSED	NOTUSED	NOTUSED	NOTUSED	NOTUSED
Elem	Y	--	--	--	--	--	--
Wavlen	371.030	--	--	--	--	--	--
Avge	32166	--	--	--	--	--	--
SDev	186.9206	--	--	--	--	--	--
%RSD	.5811117	--	--	--	--	--	--

#1	32034	--	--	--	--	--	--
#2	32298	--	--	--	--	--	--

Method: TRACE Sample Name: 240190 10X SPK DUP Operator: SMH
Run Time: 09/29/98 09:46:50
Comment:
Mode: CONC Corr. Factor: 1

Elem	Ag3280	Al2373	As1890	Ba4934	Cd2265	Cr2677	FE
Units	ppb	ppm	ppb	ppb	ppb	ppb	ppm
Avge	106.2	1.410	16640.	122.2	109.9	110.0	2.701
SDev	.2	.004	10.	.1	.2	.0	.002
%RSD	.2224	.2869	.0591	.0787	.1816	.0155	.0824

#1	106.4	1.407	16640.	122.2	109.7	110.0	2.703
#2	106.1	1.412	16630.	122.3	110.0	109.9	2.700

Elem	Mn2576	2203/1	2203/2	Pb2203	V_2924
Units	ppb	ppb	ppb	ppb	ppb
Avge	186.3	125.6	124.6	124.9	113.6
SDev	.1	.3	.8	.4	.5
%RSD	.0723	.2714	.6514	.3424	.4342

#1	186.4	125.4	125.2	125.2	113.9
#2	186.2	125.9	124.0	124.6	113.2

IntStd	1	2	3	4	5	6	7
Mode	Counts	NOTUSED	NOTUSED	NOTUSED	NOTUSED	NOTUSED	NOTUSED
Elem	Y	--	--	--	--	--	--
Wavlen	371.030	--	--	--	--	--	--
Avge	32367	--	--	--	--	--	--
SDev	285.2140	--	--	--	--	--	--
%RSD	.8811926	--	--	--	--	--	--

500033

Wavlen	371.030	--	--	--	--	--	--
Avge	33968	--	--	--	--	--	--
SDev	187.1098	--	--	--	--	--	--
%RSD	.5508361	--	--	--	--	--	--
#1	34101	--	--	--	--	--	--
#2	33836	--	--	--	--	--	--

Method: TRACE Sample Name: 238168f 100X Operator: SMH
Run Time: 09/29/98 10:16:55
Comment: *Repeat 10x*
Mode: CONC Corr. Factor: 1

Elem	Ag3280	Al2373	As1890	Ba4934	Cd2265	Cr2677	FE
Units	ppb	ppm	ppb	ppb	ppb	ppb	ppm
Avge	.6396	.0082	207.2	.8452	.1807	.1991	.0120
SDev	.5807	.0045	2.2	.0498	.0307	.5359	.0003
%RSD	90.79	54.65	1.048	5.888	16.98	269.1	2.143

#1	1.050	.0113	208.8	.8804	.2024	.5781	.0122
#2	.2290	.0050	205.7	.8101	.1590	-.1798	.0119

Elem	Mn2576	2203/1	2203/2	Pb2203	V_2924
Units	ppb	ppb	ppb	ppb	ppb
Avge	.3443	-.5907	.2031	-.0610	.0753
SDev	.1101	1.1038	.1698	.4808	.0494
%RSD	31.97	186.9	83.59	788.1	65.62

#1	.4221	-1.371	.0831	-.4010	.1102
#2	.2665	.1898	.3232	.2790	.0403

IntStd	1	2	3	4	5	6	7
Mode	Counts	NOTUSED	NOTUSED	NOTUSED	NOTUSED	NOTUSED	NOTUSED
Elem	Y	--	--	--	--	--	--
Wavlen	371.030	--	--	--	--	--	--
Avge	34550	--	--	--	--	--	--
SDev	52.14084	--	--	--	--	--	--
%RSD	.1509145	--	--	--	--	--	--

#1	34513	--	--	--	--	--	--
#2	34587	--	--	--	--	--	--

Method: TRACE Sample Name: 238168f 100X SPK Operator: SMH
Run Time: 09/29/98 10:21:56
Comment:
Mode: CONC Corr. Factor: 1

Elem	Ag3280	Al2373	As1890	Ba4934	Cd2265	Cr2677	FE
Units	ppb	ppm	ppb	ppb	ppb	ppb	ppm
Avge	89.71	1.028	121.3	105.2	108.2	104.0	1.054
SDev	2.64	.000	.7	.0	.2	.0	.000
%RSD	2.942	.0268	.5668	.0082	.2085	.0004	.0140

#1	91.58	1.028	121.7	105.2	108.4	104.0	1.054
#2	87.84	1.028	120.8	105.2	108.0	104.0	1.054

500034

Elem	Mn2576	2203/1	2203/2	Pb2203	V_2924		
Units	ppb	ppb	ppb	ppb (106.4)	ppb		
Avge	106.1	106.6	106.3	106.4	104.4		
SDev	.2	1.8	.1	.7	.1		
%RSD	.1917	1.674	.0811	.6124	.0587		
#1	106.2	105.4	106.3	106.0	104.4		
#2	105.9	107.9	106.4	106.9	104.3		
IntStd	1	2	3	4	5	6	7
Mode	Counts	NOTUSED	NOTUSED	NOTUSED	NOTUSED	NOTUSED	NOTUSED
Elem	Y	--	--	--	--	--	--
Wavlen	371.030	--	--	--	--	--	--
Avge	35115	--	--	--	--	--	--
SDev	134.8751	--	--	--	--	--	--
%RSD	.3840941	--	--	--	--	--	--
#1	35210	--	--	--	--	--	--
#2	35020	--	--	--	--	--	--

Method: TRACE Sample Name: 238168f 100X SPK DUP Operator: SMH
Run Time: 09/29/98 10:26:57
Comment:
Mode: CONC Corr. Factor: 1

Elem	Ag3280	Al2373	As1890	Ba4934	Cd2265	Cr2677	FE
Units	ppb (84.4%)	ppm	ppb ✓	ppb	ppb	ppb	ppm
Avge	85.04	1.027	118.2	105.1	108.9	104.4	1.059
SDev	.95	.001	2.7	.2	.8	.5	.005
%RSD	1.120	.1157	2.319	.2117	.7710	.4418	.4678
#1	84.36	1.026	116.3	105.2	108.3	104.1	1.055
#2	85.71	1.028	120.2	104.9	109.5	104.7	1.062

Elem	Mn2576	2203/1	2203/2	Pb2203	V_2924
Units	ppb	ppb	ppb	ppb	ppb
Avge	106.6	109.9	104.8	106.5	104.3
SDev	.7	1.7	.3	.4	1.1
%RSD	.6544	1.558	.2927	.3431	1.013
#1	106.1	111.1	104.6	106.8	103.6
#2	107.1	108.7	105.1	106.3	105.1

IntStd	1	2	3	4	5	6	7
Mode	Counts	NOTUSED	NOTUSED	NOTUSED	NOTUSED	NOTUSED	NOTUSED
Elem	Y	--	--	--	--	--	--
Wavlen	371.030	--	--	--	--	--	--
Avge	34142	--	--	--	--	--	--
SDev	870.2551	--	--	--	--	--	--
%RSD	2.548935	--	--	--	--	--	--
#1	34757	--	--	--	--	--	--
#2	33527	--	--	--	--	--	--

500035

Method: TRACE Sample Name: 238168f 100X DIG SPK Operator: SMH
 Run Time: 09/29/98 10:31:58
 Comment:
 Mode: CONC Corr. Factor: 1

Elem	Ag3280	Al2373	As1890	Ba4934	Cd2265	Cr2677	FE
Units	ppb	ppm	ppb	ppb	ppb	ppb	ppm
Avge	.0085	.0031	108.3	.6329	.0908	-.0352	.0073
SDev	.1153	.0022	1.1	.0257	.0394	.0706	.0002
%RSD	1358.	70.81	.9780	4.063	43.38	200.7	2.647

#1	.0901	.0015	107.5	.6511	.1187	-.0851	.0074
#2	-.0731	.0046	109.0	.6147	.0630	.0147	.0071

Elem	Mn2576	2203/1	2203/2	Pb2203	V_2924
Units	ppb	ppb	ppb	ppb	ppb
Avge	.0819	-1.156	-.0764	-.4356	.0007
SDev	.0001	1.085	.5865	.0300	.1644
%RSD	.0789	93.83	768.0	6.887	23430.

#1	.0819	-.3889	-.4911	-.4569	.1170
#2	.0820	-1.923	.3383	-.4144	-.1156

IntStd	1	2	3	4	5	6	7
Mode	Counts	NOTUSED	NOTUSED	NOTUSED	NOTUSED	NOTUSED	NOTUSED
Elem	Y	--	--	--	--	--	--
Wavlen	371.030	--	--	--	--	--	--
Avge	32827	--	--	--	--	--	--
SDev	36.86623	--	--	--	--	--	--
%RSD	.1123042	--	--	--	--	--	--

#1	32853	--	--	--	--	--	--
#2	32801	--	--	--	--	--	--

Method: TRACE Sample Name: 238168f 100X DIG SD Operator: SMH
 Run Time: 09/29/98 10:36:58
 Comment:
 Mode: CONC Corr. Factor: 1

Elem	Ag3280	Al2373	As1890	Ba4934	Cd2265	Cr2677	FE
Units	ppb	ppm	ppb	ppb	ppb	ppb	ppm
Avge	.0788	.0037	114.1	.6536	.0715	-.0855	.0070
SDev	.9663	.0041	.3	.0688	.0757	.3375	.0001
%RSD	1226.	111.4	.3043	10.53	105.9	394.8	1.671

#1	.7621	.0066	114.4	.7022	.0180	.1531	.0069
#2	-.6045	.0008	113.9	.6049	.1250	-.3241	.0071

Elem	Mn2576	2203/1	2203/2	Pb2203	V_2924
Units	ppb	ppb	ppb	ppb	ppb
Avge	.0917	-1.562	-.2507	-.6871	-.1076
SDev	.1420	1.520	.7518	.0046	.6298
%RSD	154.9	97.30	299.9	.6754	585.1

500036

#1	.1921	-.4873	-.7822	-.6838	.3377
----	-------	--------	--------	--------	-------

Avge	37.25	1.865	.2799	.8079	8.864
SDev	.07	.551	.4428	.4787	.247
%RSD	.1885	29.53	158.2	59.25	2.784

#1	37.20	2.254	.5930	1.146	9.039
#2	37.30	1.475	-.0332	.4694	8.690

IntStd	1	2	3	4	5	6	7
Mode	Counts	NOTUSED	NOTUSED	NOTUSED	NOTUSED	NOTUSED	NOTUSED
Elem	Y	--	--	--	--	--	--
Wavlen	371.030	--	--	--	--	--	--
Avge	30297	--	--	--	--	--	--
SDev	192.5789	--	--	--	--	--	--
%RSD	.6356462	--	--	--	--	--	--

#1	30433	--	--	--	--	--	--
#2	30160	--	--	--	--	--	--

Method: TRACE Sample Name: QC 21+7

Operator: SMH

Run Time: 09/29/98 11:07:02

Comment:

Mode: CONC Corr. Factor: 1

Elem	Ag3280	Al2373	As1899	Ba4934	Cd2265	Cr2677	FE
Units	ppb	ppm	ppb	ppb	ppb	ppb	ppm
Avge	503.9	.4913	592.8	485.2	525.5	498.3	.5102
SDev	.0	.0021	9.5	.2	.7	.7	.0008
%RSD	.0041	.4204	1.608	.0376	.1284	.1358	.1522

#1	503.9	.4899	599.5	485.1	525.9	498.8	.5108
#2	503.9	.4928	586.0	485.3	525.0	497.8	.5097

Elem	Mn2576	2203/1	2203/2	Pb2203	V_2924
Units	ppb	ppb	ppb	ppb	ppb
Avge	509.1	512.0	509.7	510.5	495.9
SDev	.3	4.9	1.0	.9	.6
%RSD	.0663	.9656	.2052	.1858	.1120

#1	509.4	515.4	509.0	511.1	495.5
#2	508.9	508.5	510.5	509.8	496.3

IntStd	1	2	3	4	5	6	7
Mode	Counts	NOTUSED	NOTUSED	NOTUSED	NOTUSED	NOTUSED	NOTUSED
Elem	Y	--	--	--	--	--	--
Wavlen	371.030	--	--	--	--	--	--
Avge	32688	--	--	--	--	--	--
SDev	280.2656	--	--	--	--	--	--
%RSD	.8573943	--	--	--	--	--	--

#1	32490	--	--	--	--	--	--
#2	32886	--	--	--	--	--	--

Method: TRACE Sample Name: BLANK

Operator: SMH

Run Time: 09/29/98 11:12:04

500038

Comment:

Mode: CONC Corr. Factor: 1

Elem	Ag3280	Al2373	As1890	Ba4934	Cd2265	Cr2677	FE
Units	ppb	ppm	ppb	ppb	ppb	ppb	ppm
Avge	.4805	.0078	29.56	.1707	.3060	.5253	.0007
SDev	.2101	.0010	8.20	.1168	.0109	.4238	.0001
%RSD	43.72	13.50	27.75	68.43	3.575	80.68	17.48

#1	.6291	.0070	35.36	.2532	.2983	.2256	.0007
#2	.3320	.0085	23.76	.0881	.3138	.8250	.0008

Elem	Mn2576	2203/1	2203/2	Pb2283	V_2924
Units	ppb	ppb	ppb	ppb	ppb
Avge	.1880	-1.203	.6440	.0291	.4944
SDev	.1126	2.969	3.084	1.069	.3844
%RSD	59.88	246.7	479.0	3677.	77.76

#1	.2676	-3.302	2.825	.7849	.7662
#2	.1084	.8958	-1.537	-.7267	.2225

IntStd	1	2	3	4	5	6	7
Mode	Counts	NOTUSED	NOTUSED	NOTUSED	NOTUSED	NOTUSED	NOTUSED
Elem	Y	--	--	--	--	--	--
Wavlen	371.030	--	--	--	--	--	--
Avge	35012	--	--	--	--	--	--
SDev	785.6371	--	--	--	--	--	--
%RSD	2.243879	--	--	--	--	--	--

#1	34457	--	--	--	--	--	--
#2	35568	--	--	--	--	--	--

Method: TRACE Sample Name: 239809f 10x

Operator: SMH

Run Time: 09/29/98 11:17:05

Comment:

Mode: CONC Corr. Factor: 1

Elem	Ag3280	Al2373	As1890	Ba4934	Cd2265	Cr2677	FE
Units	ppb	ppm	ppb	ppb	ppb	ppb	ppm
Avge	-.0239	.0222	39120.	4.072	.0869	1.089	1.008
SDev	.1882	.0076	65.	.025	.0333	.781	.002
%RSD	788.9	34.23	.1658	.6015	38.38	71.78	.2079

#1	-.1569	.0275	39070.	4.055	.0633	1.641	1.006
#2	.1092	.0168	39160.	4.090	.1104	.5361	1.009

Elem	Mn2576	2203/1	2203/2	Pb2203	V_2924
Units	ppb	ppb	ppb	ppb	ppb
Avge	76.26	.6993	-.0957	.1692	1.157
SDev	.17	.4062	.2518	.3032	.107
%RSD	.2278	58.09	263.0	179.2	9.207

#1	76.13	.9866	.0823	.3836	1.082
#2	76.38	.4120	-.2738	-.0452	1.233

IntStd	1	2	3	4	5	6	7
--------	---	---	---	---	---	---	---

500039

Mode	Counts	NOTUSED	NOTUSED	NOTUSED	NOTUSED	NOTUSED	NOTUSED
Elem	Y	--	--	--	--	--	--
Wavlen	371.030	--	--	--	--	--	--
Avge	32910	--	--	--	--	--	--
SDev	174.1941	--	--	--	--	--	--
%RSD	.5293021	--	--	--	--	--	--
#1	33033	--	--	--	--	--	--
#2	32787	--	--	--	--	--	--

Method: TRACE Sample Name: 239809f 10x spk Operator: SMH
Run Time: 09/29/98 11:22:06
Comment:
Mode: CONC Corr. Factor: 1

Elem	Ag3280	Al2373	As1890	Ba4934	Cd2265	Cr2677	FE
Units	ppb 55.4%	ppm	ppb 140%	ppb 103.0%	ppb 108.1%	ppb 103.4%	ppm
Avge	55.35	1.041	39260.	107.1	108.2	104.5	2.049
SDev	.26	.004	65.	.0	.2	.3	.003
%RSD	.4642	.3590	.1657	.0292	.1775	.2754	.1701
#1	55.17	1.038	39210.	107.1	108.0	104.3	2.047
#2	55.53	1.043	39310.	107.1	108.3	104.7	2.052

Elem	Mn2576	2203/1	2203/2	Pb2203	V_2924
Units	ppb	ppb	ppb	ppb 106.7%	ppb
Avge	181.5	107.4	106.7	106.9	106.1
SDev	.1	.6	2.8	2.1	.1
%RSD	.0780	.5882	2.629	1.946	.0545
#1	181.4	107.0	104.7	105.4	106.1
#2	181.6	107.9	108.7	108.4	106.0

IntStd	1	2	3	4	5	6	7
Mode	Counts	NOTUSED	NOTUSED	NOTUSED	NOTUSED	NOTUSED	NOTUSED
Elem	Y	--	--	--	--	--	--
Wavlen	371.030	--	--	--	--	--	--
Avge	31548	--	--	--	--	--	--
SDev	135.8184	--	--	--	--	--	--
%RSD	.4305096	--	--	--	--	--	--
#1	31644	--	--	--	--	--	--
#2	31452	--	--	--	--	--	--

Method: TRACE Sample Name: 239809f 10x spk dup Operator: SMH
Run Time: 09/29/98 11:27:07
Comment:
Mode: CONC Corr. Factor: 1

Elem	Ag3280	Al2373	As1890	Ba4934	Cd2265	Cr2677	FE
Units	ppb	ppm	ppb	ppb	ppb	ppb	ppm
Avge	59.54	1.045	39570.	107.0	107.4	104.3	2.053
SDev	.18	.004	46.	.1	.2	.4	.000
%RSD	.2959	.3662	.1167	.0488	.1717	.3861	.0125

500040

#1	59.67	1.047	39540.	107.0	107.5	104.6	2.052
#2	59.42	1.042	39610.	107.0	107.3	104.0	2.053

Elem	Mn2576	2203/1	2203/2	Pb2203	V_2924
Units	ppb	ppb	ppb	ppb	ppb
Avge	181.8	105.4	106.9	106.4	105.4
SDev	.0	2.3	.4	.5	.4
%RSD	.0096	2.193	.3650	.4790	.3887

#1	181.8	107.0	106.6	106.7	105.1
#2	181.8	103.8	107.2	106.0	105.7

IntStd	1	2	3	4	5	6	7
Mode	Counts	NOTUSED	NOTUSED	NOTUSED	NOTUSED	NOTUSED	NOTUSED
Elem	Y	--	--	--	--	--	--
Wavlen	371.030	--	--	--	--	--	--
Avge	32072	--	--	--	--	--	--
SDev	212.0478	--	--	--	--	--	--
%RSD	.6611589	--	--	--	--	--	--

#1	32222	--	--	--	--	--	--
#2	31922	--	--	--	--	--	--

Method: TRACE Sample Name: 239810f 10x Operator: SMH
Run Time: 09/29/98 11:32:08
Comment:
Mode: CONC Corr. Factor: 1

23-MDL between MBL & 100

Elem	Ag3280	Al2373	As1890	Ba4934	Cd2265	Cr2677	FE
Units	ppb (6.014)	ppm	ppb (4714)	ppb (155.3)	ppb (2mbL)	ppb (2mbL)	ppm
Avge	.6014	.0063	471.4	15.53	.2324	.3020	.5192
SDev	.2012	.0021	12.6	.08	.0668	.3768	.0008
%RSD	33.45	33.62	2.673	.4923	28.73	124.8	.1546

#1	.7437	.0078	480.3	15.59	.2796	.5685	.5197
#2	.4592	.0048	462.5	15.48	.1852	.0355	.5186

Elem	Mn2576	2203/1	2203/2	Pb2203	V_2924
Units	ppb	ppb	ppb	ppb (2mbL)	ppb
Avge	88.08	.2875	.2647	.2725	1.665
SDev	.21	1.693	1.138	.1953	.369
%RSD	.2333	588.9	430.0	71.67	22.13

#1	88.23	1.485	-.5400	.1344	1.926
#2	87.94	-.9097	1.069	.4105	1.405

IntStd	1	2	3	4	5	6	7
Mode	Counts	NOTUSED	NOTUSED	NOTUSED	NOTUSED	NOTUSED	NOTUSED
Elem	Y	--	--	--	--	--	--
Wavlen	371.030	--	--	--	--	--	--
Avge	33721	--	--	--	--	--	--
SDev	203.0446	--	--	--	--	--	--
%RSD	.6021277	--	--	--	--	--	--

#1	33865	--	--	--	--	--	--
----	-------	----	----	----	----	----	----

500041

#2 33578 -- -- -- -- --

Method: TRACE Sample Name: 239811f 10x Operator: SMH
Run Time: 09/29/98 11:37:09
Comment:
Mode: CONC Corr. Factor: 1

Elem	Ag3280	Al2373	As1890	Ba4934	Cd2265	Cr2677	FE
Units	ppb (MDL)	ppm	ppb (MDL)	ppb (MDL)	ppb (MDL)	ppb (MDL)	ppm
Avge	.1086	.0033	76.31	1.126	.0457	-.2701	.2841
SDev	.0073	.0025	1.28	.031	.0471	.1400	.0006
%RSD	6.697	74.65	1.679	2.784	103.0	51.82	.2074

#1	.1035	.0051	77.22	1.103	.0790	-.3691	.2837
#2	.1138	.0016	75.40	1.148	.0124	-.1711	.2845

Elem	Mn2576	2203/1	2203/2	Pb2203	V_2924
Units	ppb	ppb	ppb	ppb (MDL)	ppb
Avge	39.64	.5492	-1.669	-.9300	.2700
SDev	.04	.8649	.620	.7019	.0025
%RSD	.1117	157.5	37.18	75.47	.9295

#1	39.67	1.161	-1.230	-.4337	.2683
#2	39.61	-.0624	-2.107	-1.426	.2718

IntStd	1	2	3	4	5	6	7
Mode	Counts	NOTUSED	NOTUSED	NOTUSED	NOTUSED	NOTUSED	NOTUSED
Elem	Y	--	--	--	--	--	--
Wavlen	371.030	--	--	--	--	--	--
Avge	33099	--	--	--	--	--	--
SDev	68.77994	--	--	--	--	--	--
%RSD	.2078014	--	--	--	--	--	--

#1	33050	--	--	--	--	--	--
#2	33148	--	--	--	--	--	--

Method: TRACE Sample Name: 240054f 10x Operator: SMH
Run Time: 09/29/98 11:42:09
Comment:
Mode: CONC Corr. Factor: 1

Elem	Ag3280	Al2373	As1890	Ba4934	Cd2265	Cr2677	FE
Units	ppb (MDL)	ppm	ppb (MDL)	ppb (MDL)	ppb (MDL)	ppb (MDL)	ppm
Avge	.1526	.0040	16390.	2.176	.1013	.0147	.0912
SDev	.3509	.0031	35.	.012	.0306	.5939	.0004
%RSD	229.9	77.39	.2119	.5356	30.22	4043.	.4676

#1	-.0955	.0018	16370.	2.168	.0796	-.4053	.0909
#2	.4008	.0062	16410.	2.184	.1229	.4346	.0915

Elem	Mn2576	2203/1	2203/2	Pb2203	V_2924
Units	ppb	ppb	ppb	ppb (MDL)	ppb
Avge	16.77	.2403	-1.013	-.5951	.2148
SDev	.20	.9067	1.541	.7258	.0905
%RSD	1.173	377.3	152.2	121.9	42.13

500042

#1	16.63	-.4009	.0770	-.0819	.1508		
#2	16.90	.8815	-2.102	-1.108	.2788		
IntStd	1	2	3	4	5	6	7
Mode	Counts	NOTUSED	NOTUSED	NOTUSED	NOTUSED	NOTUSED	NOTUSED
Elem	Y	--	--	--	--	--	--
Wavlen	371.030	--	--	--	--	--	--
Avge	33455	--	--	--	--	--	--
SDev	417.3090	--	--	--	--	--	--
%RSD	1.247359	--	--	--	--	--	--
#1	33750	--	--	--	--	--	--
#2	33160	--	--	--	--	--	--

Method: TRACE Sample Name: 240190f 10x Operator: SMH
 Run Time: 09/29/98 11:47:10
 Comment:
 Mode: CONC Corr. Factor: 1

Elem	Ag3280	Al2373	As1890	Ba4934	Cd2265	Cr2677	FE
Units	ppb (LMDL)	ppm	ppb (19.100)	ppb (96.81)	ppb (LMDL)	ppb (14.23)	ppm
Avge	.2588	.0819	19110.	9.681	.1452	1.473	.4689
SDev	.3093	.0026	16.	.029	.0599	.259	.0005
%RSD	119.5	3.121	.0816	.3000	41.24	17.62	.1094
#1	.0401	.0801	19100.	9.661	.1028	1.289	.4686
#2	.4774	.0837	19120.	9.702	.1875	1.656	.4693

Elem	Mn2576	2203/1	2203/2	Pb2203	V_2924	
Units	ppb	ppb	ppb	ppb (17.00)	ppb	
Avge	28.86	2.707	1.197	1.700	5.099	
SDev	.06	1.719	.112	.647	.223	
%RSD	.2068	63.52	9.339	38.06	4.375	
#1	28.81	3.923	1.276	2.158	4.941	
#2	28.90	1.491	1.118	1.243	5.257	

IntStd	1	2	3	4	5	6	7
Mode	Counts	NOTUSED	NOTUSED	NOTUSED	NOTUSED	NOTUSED	NOTUSED
Elem	Y	--	--	--	--	--	--
Wavlen	371.030	--	--	--	--	--	--
Avge	31330	--	--	--	--	--	--
SDev	37.24188	--	--	--	--	--	--
%RSD	.1188696	--	--	--	--	--	--
#1	31304	--	--	--	--	--	--
#2	31356	--	--	--	--	--	--

Method: TRACE Sample Name: 240191f 10x Operator: SMH
 Run Time: 09/29/98 11:52:11
 Comment:
 Mode: CONC Corr. Factor: 1

Elem	Ag3280	Al2373	As1890	Ba4934	Cd2265	Cr2677	FE
------	--------	--------	--------	--------	--------	--------	----

500043

Avge	33310	--	--	--	--	--	--
SDev	174.3819	--	--	--	--	--	--
%RSD	.5235075	--	--	--	--	--	--
#1	33434	--	--	--	--	--	--
#2	33187	--	--	--	--	--	--

Method: TRACE Sample Name: 240193f 10x Operator: SMH
 Run Time: 09/29/98 12:02:13
 Comment:
 Mode: CONC Corr. Factor: 1

Elem	Ag3280	Al2373	As1890	Ba4934	Cd2265	Cr2677	FE
Units	ppb	ppm	ppb	ppb	ppb	ppb	ppm
Avge	.3595	.0479	S206800.	5.135	.1485	3.417	2.437
SDev	.1288	.0038	1976.	.052	.0466	.011	.000
%RSD	35.82	7.950	.9554	1.014	31.36	.3167	.0098
#1	.4506	.0506	S208200.	5.171	.1156	3.409	2.437
#2	.2684	.0452	S205400.	5.098	.1814	3.424	2.437

Elem	Mn2576	2203/1	2203/2	Pb2203	V_2924
Units	ppb	ppb	ppb	ppb	ppb
Avge	94.72	-1.564	.3756	-.2702	1.584
SDev	.07	.478	.2683	.0198	.121
%RSD	.0776	30.56	71.45	7.334	7.632
#1	94.77	-1.902	.5653	-.2562	1.669
#2	94.67	-1.226	.1858	-.2842	1.498

IntStd	1	2	3	4	5	6	7
Mode	Counts	NOTUSED	NOTUSED	NOTUSED	NOTUSED	NOTUSED	NOTUSED
Elem	Y	--	--	--	--	--	--
Wavlen	371.030	--	--	--	--	--	--
Avge	29868	--	--	--	--	--	--
SDev	289.5506	--	--	--	--	--	--
%RSD	.9694181	--	--	--	--	--	--
#1	29664	--	--	--	--	--	--
#2	30073	--	--	--	--	--	--

Method: TRACE Sample Name: qc 21+7 Operator: SMH
 Run Time: 09/29/98 12:07:14
 Comment:
 Mode: CONC Corr. Factor: 1

Elem	Ag3280	Al2373	As1890	Ba4934	Cd2265	Cr2677	FE
Units	ppb	ppm	ppb	ppb	ppb	ppb	ppm
Avge	449.8	.4899	830.3	484.6	526.4	497.3	.5106
SDev	12.1	.0001	127.0	.0	.8	.8	.0013
%RSD	2.693	.0294	15.29	.0047	.1551	.1600	.2475
#1	441.2	.4898	740.6	484.6	526.9	497.9	.5097
#2	458.4	.4900	920.1	484.6	525.8	496.7	.5115

500044

Elem	Mn2576	2203/1	2203/2	Pb2203	V_2924
Units	ppb	ppb	ppb	ppb	ppb
Avge	508.5	512.6	509.2	510.3	494.8
SDev	.5	2.5	2.3	2.4	.4
%RSD	.1037	.4922	.4587	.4699	.0711
#1	508.8	510.8	507.6	508.6	494.5
#2	508.1	514.4	510.9	512.0	495.0

IntStd	1	2	3	4	5	6	7
Mode	Counts	NOTUSED	NOTUSED	NOTUSED	NOTUSED	NOTUSED	NOTUSED
Elem	Y	--	--	--	--	--	--
Wavlen	371.030	--	--	--	--	--	--
Avge	34375	--	--	--	--	--	--
SDev	56.99391	--	--	--	--	--	--
%RSD	.1657997	--	--	--	--	--	--
#1	34415	--	--	--	--	--	--
#2	34335	--	--	--	--	--	--

Method: TRACE Sample Name: blank
Run Time: 09/29/98 12:12:15
Comment:
Mode: CONC Corr. Factor: 1

Operator: SMH

Elem	Ag3280	Al2373	As1890	Ba4934	Cd2265	Cr2677	FE
Units	ppb	ppm	ppb	ppb	ppb	ppb	ppm
Avge	1.630	.0038	78.62	.1426	.2714	-.0606	.0005
SDev	.052	.0035	5.93	.0205	.1112	.0428	.0000
%RSD	3.210	90.83	7.538	14.39	40.97	70.69	6.947

#1	1.667	.0014	82.81	.1281	.3500	-.0909	.0005
#2	1.593	.0063	74.43	.1571	.1928	-.0303	.0004

Elem	Mn2576	2203/1	2203/2	Pb2203	V_2924
Units	ppb	ppb	ppb	ppb	ppb
Avge	.2627	-1.015	-1.006	-1.009	.6718
SDev	.0026	.271	1.382	.832	.0428
%RSD	1.001	26.66	137.4	82.45	6.375

#1	.2645	-1.206	-.0288	-.4206	.7021
#2	.2608	-.8235	-1.984	-1.597	.6415

IntStd	1	2	3	4	5	6	7
Mode	Counts	NOTUSED	NOTUSED	NOTUSED	NOTUSED	NOTUSED	NOTUSED
Elem	Y	--	--	--	--	--	--
Wavlen	371.030	--	--	--	--	--	--
Avge	35085	--	--	--	--	--	--
SDev	337.1187	--	--	--	--	--	--
%RSD	.9608539	--	--	--	--	--	--

#1	34847	--	--	--	--	--	--
#2	35324	--	--	--	--	--	--

Method: TRACE Sample Name: ics

Run Time: 09/29/98 12:17:16

Operator: SMH

Comment:

Mode: CONC Corr. Factor: 1

Elem	Ag3286	Al2373	As1890	Ba4934	Cd2265	Cr2677	FE
Units	ppb	ppm	ppb	ppb	ppb	ppb	ppm
Avge	536.3	510.0	636.8	499.2	481.0	449.0	192.8
SDev	3.9	.8	3.2	.8	1.9	.7	.6
%RSD	.7334	.1488	.5029	.1568	.3944	.1554	.2880
#1	533.5	510.5	639.0	498.7	482.3	449.5	193.2
#2	539.1	509.5	634.5	499.8	479.6	448.5	192.4
Elem	Mn2576	2203/1	2203/2	Pb2203	V_2924		
Units	ppb	ppb	ppb	ppb	ppb		
Avge	500.3	736.9	343.7	474.6	500.7		
SDev	.9	9.4	1.5	4.1	1.0		
%RSD	.1720	1.272	.4315	.8660	.2060		
#1	500.9	743.5	344.7	477.5	501.4		
#2	499.7	730.2	342.6	471.7	500.0		
IntStd	1	2	3	4	5	6	7
Mode	Counts	NOTUSED	NOTUSED	NOTUSED	NOTUSED	NOTUSED	NOTUSED
Elem	Y	--	--	--	--	--	--
Wavlen	371.030	--	--	--	--	--	--
Avge	29783	--	--	--	--	--	--
SDev	252.0256	--	--	--	--	--	--
%RSD	.8462111	--	--	--	--	--	--
#1	29605	--	--	--	--	--	--
#2	29961	--	--	--	--	--	--

500046

NORTHERN LAKE SERVICE, INC.

ATTACHMENT 6

LEVEL 4 - QUALITY CONTROL DATA PACKAGE EXAMPLES

ICP METALS - METHOD 200.7 / 6010 (Water / Soil)

- NLS ICP QC Data Forms for Metals Analysis of Soil
 - NLS Analytical Bench Sheets for ICP Metals
- NLS ICP Metals Instrument Calibration / QC / Analysis Printouts